scientific reports

Check for updates

OPEN

A quantum-inspired classifier for clonogenic assay evaluations

Giuseppe Sergioli[1,7]✉, Carmelo Militello[2,7], Leonardo Rundo[3,4], Luigi Minafra[2], Filippo Torrisi[5], Giorgio Russo[2], Keng Loon Chow[1] & Roberto Giuntini[1,6]

Recent advances in Quantum Machine Learning (QML) have provided benefits to several computational processes, drastically reducing the time complexity. Another approach of combining quantum information theory with machine learning—without involving quantum computers—is known as Quantum-inspired Machine Learning (QiML), which exploits the expressive power of the quantum language to increase the accuracy of the process (rather than reducing the time complexity). In this work, we propose a large-scale experiment based on the application of a binary classifier inspired by quantum information theory to the biomedical imaging context in clonogenic assay evaluation to identify the most discriminative feature, allowing us to enhance cell colony segmentation. This innovative approach offers a two-fold result: (1) among the extracted and analyzed image features, *homogeneity* is shown to be a relevant feature in detecting challenging cell colonies; and (2) the proposed quantum-inspired classifier is a novel and outstanding methodology, compared to conventional machine learning classifiers, for the evaluation of clonogenic assays.

The synergies between machine learning and quantum theory has received a massive increase in the last decades[1–4]. One reason is due to the need for dealing with the current exponential growth of data being captured and stored[5]. Standard procedures frequently exhibit relevant slowdown in performances once these procedures are used in the treatment of big data. The advantages of quantum computation over conventional computation are widely discussed including the drastic reduction in the time complexity of a large set of algorithms. Moreover, recent progress made in the direction of producing real quantum computers suggested the combination between machine learning and quantum computing as a natural connection. However, the discussion involving real quantum computers is not the only way to exploit the properties of quantum theory at the service of machine learning; recent works showed that quantum information can inspire new ways to design machine learning algorithms without requiring the use of quantum computers[6,7]. In other words, it is possible to develop classical algorithms that are inspired by quantum information. This formalism, known as Quantum-inspired Machine Learning (QiML)[8], is motivated by the fact that the expressive power of the quantum language makes it possible to gain relevant benefits for computational processes. QiML effectively exploits properties of quantum information theory to increase the accuracy of the process, rather than reducing the time complexity, such as in the case of standard Quantum Machine Learning.

Recently, promising results from QiML have shown to efficiently solve different kinds of classification problems, i.e., the problem of assigning each object of a given dataset to a membership class[9]. In particular, the work[6] proposed a QiML technique for binary classification inspired by the theory of quantum state discrimination[10], whereby the idea was in that discrimination between quantum states produces a very efficient classification process. The authors compared the QiML algorithm—called the Helstrom Quantum Classifier (HQC)—with other commonly used classifiers, by applying these classifiers to several conventional machine learning repository datasets, and they had obtained results which showed an average supremacy of the HQC compared to the other classifiers. This innovative approach suggested applications of the HQC on real-world datasets. A first attempt of the application of QiML technique to biological datasets have also previously been introduced[11].

In this work, we show how the application of quantum information theory to machine learning turns out to be particularly beneficial in the context of biomedical images. In particular, we show a large-scale application of the HQC to support the evaluation in clonogenic assays. A clonogenic assay is a quantification technique of the survival degree of in vitro cell cultures, which is based on the ability of a single cell to grow and form a

[1]University of Cagliari, Cagliari, Italy. [2]Institute of Molecular Bioimaging and Physiology, Italian National Research Council, Cefalú, Palermo, Italy. [3]Department of Radiology, University of Cambridge, Cambridge, UK. [4]Cancer Research UK Cambridge Centre, University of Cambridge, Cambridge, UK. [5]Department of Biomedical and Biotechnological Sciences, University of Catania, Catania, Italy. [6]Centro Linceo Interdisciplinare "Beniamino Segre", Accademia dei Lincei, Rome, Italy. [7]These authors contributed equally: G. Sergioli and C. Militello. ✉email: giuseppe.sergioli@gmail.com

colony. To quantify the number and size of cell colonies after irradiation or drug administration (e.g., cytotoxic agents)[12,13], a measure to assess the anti-proliferative use of these treatments is required. After some preparatory phases (i.e., plating, incubation, cell treatment[14]) the standard procedure includes colony counting with a stereo-microscope[15,16]. Traditionally, clonogenic assay evaluation is performed by manually counting the colonies composed of at least 50 densely-packed cells. To estimate the effect of the treatment on cell survival, the Plating Efficiency (PE), which is the fraction of colonies obtained from untreated cells, and the Surviving Fraction (SF) of cells after any treatment, are measured[14]. From a biological point of view, this quantification—which aims at identifying and quantifying the colonies grown following a specific treatment (e.g., radiation or drug/substance administration)—still represents an open problem. In fact, there are critical issues that are not completely solved yet, such as: (1) the high variability in the scenario related to the specific cell line used, and (2) the subjectivity in human quantification procedures. Depending on the cell line analyzed, the generated colonies can have very different characteristics, such as size, shape and heterogeneity (i.e., some colonies are small with well-defined boundaries and high-contrast compared to the background, whereas others are large and evanescent). A further difficulty of the evaluation process involves colonies which grow considerably and tend to merge together. Along with these high variabilities, human subjectivity can also affect the manual procedure. These issues introduce compelling challenges in manual procedures used in colony detection and quantification. Biologists typically attempt to reduce this lack of reliability, by considering the average of several manual counts.

Considering these challenging scenarios, recent research efforts[17–19] have proposed an alternative solution to common counting procedures. In particular, rather than quantifying the number of colonies, the area covered by cell colonies is determined. Experimental evidence showed that the area covered by a colony is correlated to the colony number and size. In fact, area-based approaches—which determines the area of the well plates covered by the colonies—represent a useful alternative, allowing us to provide a measure equivalent to the exact count of colonies. To quantify the number of colonies grown after a treatment, a post-processing step, which evaluates the number of colonies contained in the segmented regions, would be integrated into the processing pipeline in area-based approaches. This surrogate measure allows us to overcome some of the problems highlighted above, such as the difficulty of correctly quantifying the colonies which, due to the growth, have merged together.

In this work, an area-based approach is proposed, which is based on imaging characteristics that are not observable by the naked human eye. In particular, we start from the intrinsic assumption that biomedical images often convey information—contained in so-called descriptors (i.e., *contrast*, *correlation*, *energy* and *homogeneity*)—about the phenotype of the underlying physiopathology, which is not always easily identifiable by a simple visual inspection by the human eye. These descriptors can be revealed by quantitative analysis, by converting the images into a high-dimensional dataset, and making it possible to extract further information. In our biological setting, along with the native imaging characteristics—i.e., Red Green Blue (*RGB*) and International Commission on Illumination (CIE) $L^*u^*v^*$ pixel values—these descriptors are used in the classification of colonies vs. background area, where these high-dimensional set of descriptor features makes it possible to enhance the detection of difficult cell lines.

Summarizing, the area-based approach strictly depends on the colonies vs. background binary classification, where the descriptors assume the role of the features. Several algorithms and techniques have already been explored in the classification of colonies vs. background area and, specifically, in the context of clonogenic assays[17,20–25]. We here introduce a multidisciplinary effort which involves image processing, machine learning, quantum information theory, and cell biology (see Fig. 2a). In particular, we apply the HQC to the binary classification of colonies vs. background area over four different cell lines. Each cell line is given by a dataset where each row in the dataset is a vector that the HQC has to classify as belonging to a colony area or to a background area by using the information provided by the corresponding features. Our experimental study is divided into two stages: (1) we analyze the relevance of different features (descriptors) during the classification process to identify the one that optimizes the accuracy in the colonies vs. background discrimination, and (2) we provide a full comparison between HQC and other conventional classifiers aiming to show that the HQC deserves to be considered as a performant classifier in the real context of clonogenic assay evaluations.

Materials and methods

This section first describes the datasets analyzed in our experiments (i.e., the well plates with cell colonies) along with how the features—which are the inputs of the HQC—were extracted and prepared from the Grey Level Co-occurrence Matrix (GLCM) of the well plate images[26,27]. The section then outlines the setup of the HQC.

Dataset description. The imaging data used for clonogenic assay evaluation were images of 6-well plates (produced by Corning Inc., Corning, NY, USA) regarding four different cell lines: (1) MDA-MD-231 is a human metastatic breast cancer cell line which represents an *in vitro* model of a subgroup of breast cancer, particularly radioresistant and refractory to conventional therapies; (2) U87-MG is a human glioblastoma multiforme cell line; (3) MCF7 is a breast epithelial cell line which is often used in the field of cell biology; and (4) U251 is a human glioblastoma cell line used in brain cancer research and drug development. Figure 1 shows an example of each cell line analyzed in this study.

The images of the well plates were acquired using a common desktop flat-bed scanner, with a resolution of 800 dpi and a 24-bit color-depth. For each well plate image, only a squared area (about 300×300 pixels) composed of about 10^5 pixels was considered to reduce the computational time. Thirty well plates for each cell line were considered, treated with different doses of particles (i.e., protons, photons) and/or cytotoxic agents (e.g., curcumin, SLNB).

Such cell lines considered in this work have different characteristics, with colonies having different size, shape, contrast, and uniformity. In these trials, we considered the most challenging scenarios where MDA-MD-231 and

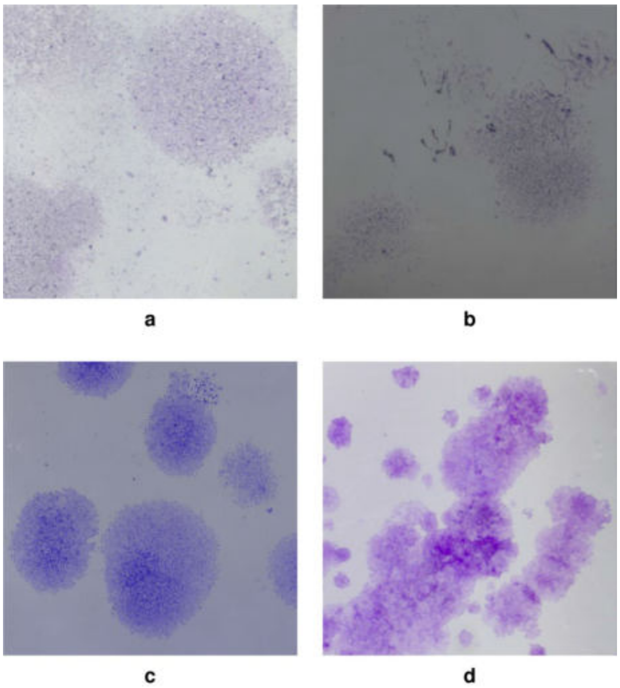

Figure 1. Examples of the wells analyzed in this study. Colony images are displayed for each cell line: (**a**) MDA-MD-231. (**b**) U87-MG. (**c**) U251. (**d**) MCF7. Images are depicted by a reduced 0.25 factor to the original acquisition size.

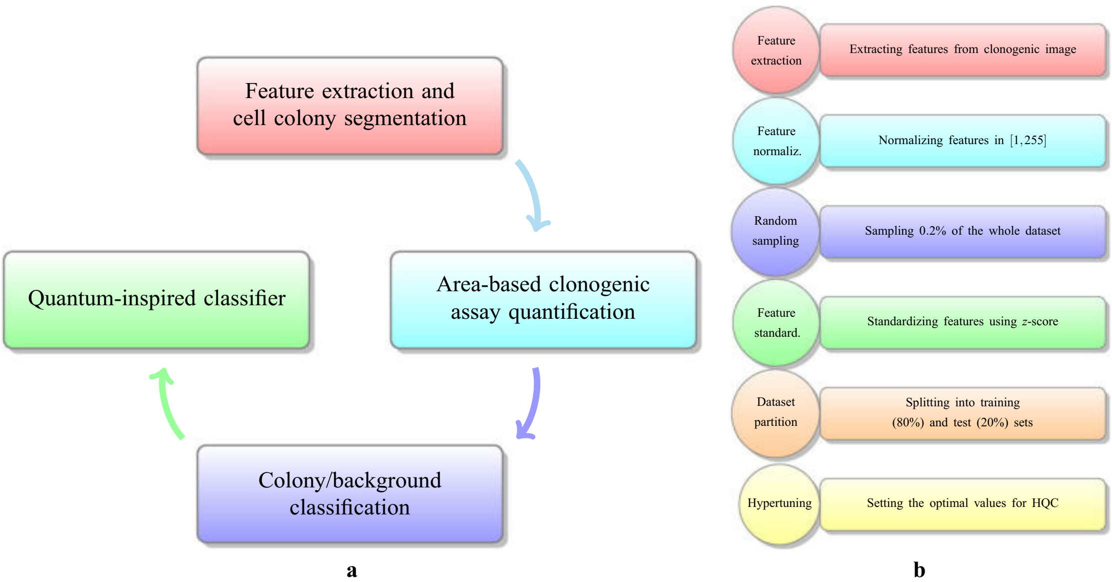

Figure 2. Conceptualization. The general scheme of the process: (**a**) conceptual scheme of the proposed multidisciplinary approach involving image processing, machine learning, quantum information theory and cell biology. (**b**) The pre-processing steps.

U87-MG are cell lines particularly difficult to quantify in clonogenic assays because it produces non-compact colonies, and can sometimes be evanescent because they tend to take up very few crystal-violet, a dye commonly added to the culture plate by biologists to increase the contrast of the colonies.

Dataset preparation. The initial part of the experiment was devoted to the preparation of the datasets. In this experiment, we applied the HQC to the four considered cell lines. For each cell line, we considered 30 images, which were obtained from 30 different well plates. In order to quantify the effectiveness of the classifier and to determine the most discriminative feature, before applying the HQC, each image was segmented to define the ground-truth, which is then used to compare the classification result achieved by the HQC and the competing classifiers. These masks—validated by biologists—were the result of colonies-background segmentation by means of spatial Fuzzy C-Means (sFCM) clustering using the pixelwise entropy feature maps of the well plate. The value 1 (or 0) associated with each pixel within this mask represented the class membership (or not) of the pixel to a colony. Finally, the mask obtained by sFCM clustering underwent a post-processing step which removes small connected-components, to consider only the colonies comprising of at least 50 densely-packed cells[14]. The choice of entropy to determine the ground-truth was motivated by a previous work[19], which showed a high correlation between area-based quantification by entropy and manual quantification.

A particular aim of the experiment is to compare different inputs to find out whether, in general, any feature outperforms the others in the classification process. In particular, the six investigated features in our experiment were: the *RGB* and $L^*u^*v^*$ (where L^* represents the lightness, while u^* and v^* denote the chromaticity) color space encodings, as well as the *contrast*, *correlation*, *energy* and *homogeneity* descriptors. For this reason, the dataset was split into 6 different datasets (one for each feature) and properly formatted to obtain a file suitable for the HQC. In particular, the obtained segmentation mask (our ground truth) was 'serialized' forming a set where each row, which represents the characteristics of each pixel, is structured as follows: (1) the first two columns represent the two-dimensional coordinates of the pixel, (2) the last column denotes the class label of the pixel (1 if belongs to a colony, and 0 if the pixel belongs to a background), and (3) the middle columns store the values of the features for each pixel. Prior to classification, all the values of the features were normalized in the range [1, 255]. Hence, we performed the experiment over 4 cell lines, each one included 30 different well images that yielded 6 distinct datasets; therefore, the total number of datasets is 720.

Extracted features. For each input image, along with the original encoding in the *RGB* and $L^*u^*v^*$ color spaces, the following feature maps were also extracted from the GLCM, namely: *contrast*, *correlation*, *energy*, and *homogeneity*.

More specifically: (1) *contrast* represents a measure of the intensity contrast between a pixel and its neighbor over the whole image, (2) *correlation* denotes a measure of how correlated a pixel is to its neighbor over the whole image, (3) *energy* (i.e., angular second moment) yields the sum of squared elements in the GLCM, and (4) *homogeneity* quantifies the closeness of the distribution of elements in the GLCM to the GLCM diagonal. The feature maps were computed using the MatLab (The Mathworks, Natick, MA, USA) built-in function `graycoprops`, which relies upon the `graycomatrix` function.

These GLCM-based local texture descriptors are comprised among the so-called Haralick's features[26,27]. In particular, the input images were quantitized (i.e., histogram rebinning) by using L gray-levels and processed by a sliding squared window of size $\omega \times \omega$ pixels[28]. The parameters for the feature extraction were: sliding window size $\omega \times \omega = 5$ pixels, number of gray-level bins $L = 256$. For a detailed description of the mathematical formulation, please refer to Supplementary Material S1.

We compared the various features extracted individually, with the goal of understanding the most discriminative one. In summary, the HQC was tested on the following set of features: (1) *RGB* color space triplet, (2) $L^*u^*v^*$ color space triplet, (3) *contrast*, (4) *correlation*, (5) *energy*, and (6) *homogeneity*. The use of such a procedure, which separately analyzed the 6 image features, rather than a wrapper method for feature selection[29] was mostly motivated by computational limitations[30]. In wrapper methods, the feature selection criterion is based on the performance of a subset of the predictors, by searching for the highest classification performance. Indeed, wrapper methods rely on the classification evaluation for obtaining the optimal feature subset: this search in the feature space is a non-deterministic polynomial-time hard (NP-hard) problem. Exhaustive search methods are computationally intensive and infeasible for large-scale datasets, thus search methods and metaheuristics are typically used to find sub-optimal solutions in the search space[31]. Importantly, overuse of the accuracy estimates in feature subset selection may cause overfitting in the feature subset space due to multiple comparisons and hinders generalization capabilities[32]. Therefore, in our experiments, we aimed at identifying the most discriminative feature in colony vs. background classification by fairly evaluating several different binary classifiers.

Setup of the HQC. Following standard procedures, pre-processing was applied to the 720 datasets before training the HQC on these datasets. In particular, the pre-processing phase consisted of three steps: (1) random sampling, (2) standardization, and (3) splitting the sampled dataset into development and test sets (80% and 20%, respectively).

The random sampling simply consisted of the random extraction of a subset over each of the initial 720 datasets. Each of the initial dataset has cardinality 301^2 (the number of the pixels) while the sampled dataset has cardinality 181, hence we considered a random sampling pre-processing step that randomly extracted a different 0.2% sample from each of the 720 datasets. In particular, there were 30 datasets for each cell line and each feature, and a different 0.2% random sample was extracted from each of the 30 datasets, to train the HQC. In the standardization step, the six features of the sampled dataset (*RGB*, $L^*u^*v^*$, *contrast*, *correlation*, *energy* and *homogeneity*) were standardized to have mean equal to 0 and standard deviation equal to 1 by using the individual feature's mean and standard deviation values (i.e., z-score standardization).

The HQC was trained on the training set and hypertuning is performed simultaneously using the classifier's four hyperparameters: (1) the rescaling factor, (2) the encoding method, (3) the number of copies taken for the density matrices, and (4) the class weights assigned to the quantum centroids in the HQC.

The first hyperparameter, the rescaling factor, involves the multiplication of the values of each feature with a scalar factor. As already shown[33], even though this procedure is generally not beneficial for conventional classification approaches, a suitable choice for the rescaling factor can produce relevant advantages for the HQC in terms of the improvement to the classifier's performance. We considered rescaling factors in the set $\{0.5, 1, 1.5, 2\}$. The second hyperparameter was the encoding method that was adopted. In order to apply the HQC, we need to encode each row data $\mathbf{X}$ (a real vector whose elements are the the respective features) into a density matrix (also called *density pattern*), ρ_X, which is the standard mathematical object representing a quantum state. In our experiment we considered two different encoding methods: the *stereographic encoding* (SE) and the *amplitude encoding* (AE). Intuitively, the SE is inspired by geometrical considerations and associates each real vector $\mathbf{X}$ to a point of a hypersphere with unitary radius, which has a natural interpretation in the standard quantum scenario. On the other hand, the AE is based on the idea of keeping the information about the amplitude of the vector by considering this as a particular feature[34]. Both the SE and AE were previously detailed[35]. The third hyperparameter was given by taking a certain number of *copies* for each row vector $\mathbf{X}$ of the encoded training set (which has now been encoded into density matrices). Formally, taking a certain number of *copies* is provided by tensor products of the density patterns ρ_X with itself (i.e., $\rho_X \otimes \rho_X \otimes \ldots \otimes \rho_X$), obtaining a new set of density patterns. The idea for this procedure originates from quantum information theory where—unlike in the classical case—taking copies of a given state ρ provides additional information with respect to the initial state. In particular, considering more copies of the states can increase the probability of providing a correct discrimination between two quantum states[6]. Let us remark how this is relevant because it suggests that the performance of the HQC could be, in principle, improved by increasing the number of the copies for each density pattern obtained from the initial dataset. In the experiment, we considered a number of copies equal to $\{1, 2, 3, 4\}$ for the image features *RGB* and $L^*u^*v^*$; and $\{1, 2, 3, 4, 5\}$ for the image features *contrast*, *correlation*, *energy* and *homogeneity*. The last hyperparameter was represented by two types of class weights assigned to the two quantum centroids in the HQC. The first type, called equiprobable, assigns equal weights of 1/2 to both of the two quantum centroids; the second type, called weighted, assigns to each centroid a weight which is proportional to the cardinality of the respective classes[6]. The pre-processing and hypertuning steps are outlined in Fig. 2b. The performance metrics considered in the experiment were the balanced accuracy and Area Under the Receiver Operating Characteristic (AUROC) scores. The balanced accuracy score was chosen to ensure the evaluation of the classification task of a pixel as either a colony or a background are both equally relevant. The AUROC score was chosen to enable the evaluation of the overall performance of a classifier. To obtain the combination of hyperparameters which maximizes any of the two performance metrics, we first partitioned the development set into 5 subsets of the same cardinality. According to the most common experimental procedures, during the development phase, we performed a 5-fold cross-validation. The model performance for each combination of hyperparameters is obtained by averaging the validation set's performance over the 5 rounds.

The same procedure was performed to determine the best combination of hyperparameters for the other 18 (generally, high performing and well-established) conventional machine learning classifiers. The 18 classifiers considered were: AdaBoost, Bernoulli Naïve Bayes, Dummy Classifier, Extra Trees, Gaussian Naïve Bayes, Gradient Boosting, Linear Discriminant Analysis, Logistic Regression, Multi Layer Perceptron, Nearest Centroid, Nearest Neighbors, Passive Aggressive Classifier, Perceptron, Quadratic Discriminant Analysis, Random Forest, SVM (with linear kernel), SVM (with polynomial kernel), and SVM (with RBF kernel). For the performance metric AUROC score, three classifiers—Nearest Centroid, Passive Aggressive Classifier and Perceptron—were excluded from this performance metric analysis due to the unavailability of the predicted class probabilities required in the AUROC score calculation.

The HQC was also compared with these 18 other classifiers (for the balance accuracy score) or 15 other classifiers (for the AUROC score) by determining the best image feature (among *RGB*, $L^*u^*v^*$, *contrast*, *correlation*, *energy*, or *homogeneity*) and the best classifier—i.e., the HQC or the other 18 (or 15) classifiers—which yielded the highest performance on the test set, individually for each of the two performance metrics, balance accuracy and AUROC scores respectively.

Experimental results

Experimental tests were carried out exhaustively, in order to quantify the effectiveness of the classifier and to establish the most discriminative feature (in terms of colonies vs. background). As a reference for comparing the HQC classification results against the other standard classifiers, we used the ground-truth masks previously calculated and validated by experimental biologists. These masks were the result of colonies-background segmentation by means of sFCM clustering using entropy as a discriminant[19]. The mask obtained by the sFCM clustering, prior to be used as ground-truth, underwent a post-processing step (i.e., morphological operations and small connected-component removal), aiming to cope with the noise in the well background and to consider only the colonies composed of, at least, 50 densely-packed cells[14].

We first present the experimental results for the best performing image feature for each of the four cell lines, which can be found under section Supplementary Material S2. The results for each cell line consists of two parts. The first part shows: (1) heatmaps of the balanced accuracy scores over the 30 datasets for the HQC and the other 18 classifiers, obtained by hypertuning the hyperparameters of each classifier in order to optimize the balanced accuracy score; (2) heatmaps of a classifier outperforming ("wins") over another classifier ("losses") out of the 30 datasets; and (3) a table showing the averaged scores over the 30 datasets for each of the 6 image features and 18 classifiers. The second part for each cell line is analogous to the first, where the role of the balanced accuracy score is replaced by the AUROC score. The whole performance evaluation was executed using the test set. The aim of this experimental procedure was to find the most informative feature that classifies a pixel as either a colony or a background, i.e., the feature that maximizes the value of the balanced accuracy and the AUROC scores, respectively.

Cell line	Best image feature	Best classifier	Balanced accuracy	Jaccard index	Dice coefficient
MDA-MD-231	**Homogeneity**	**Helstrom Quantum Classifier**	**0.959 ± 0.036**	**0.918 ± 0.080**	**0.955 ± 0.046**
U87-MG	**Homogeneity**	**Helstrom Quantum Classifier**	**0.919 ± 0.050**	**0.790 ± 0.121**	**0.877 ± 0.078**
MCF7	$L^*u^*v^*$	Gaussian Naïve Bayes	0.969 ± 0.034	0.892 ± 0.088	0.941 ± 0.050
	$\boldsymbol{L^*u^*v^*}$	**Helstrom Quantum Classifier**	**0.965 ± 0.033**	**0.882 ± 0.084**	**0.935 ± 0.048**
	$L^*u^*v^*$	Multi Layer Perceptron	0.965 ± 0.042	0.898 ± 0.100	0.943 ± 0.059
U251	Homogeneity	SVM - RBF	0.980 ± 0.033	0.948 ± 0.079	0.971 ± 0.047
	Homogeneity	**Helstrom Quantum Classifier**	**0.979 ± 0.029**	**0.944 ± 0.078**	**0.970 ± 0.045**

Table 1. The mean and standard deviation balance accuracy score (with respect to 30 datasets) for the best performing image feature and classifiers (up to and including HQC and classifiers where the score was tied with HQC), with corresponding mean and standard deviation Jaccard index and Dice coefficient, for cell lines MDA-MD-231, U87-MG, MCF7 and U251. The rows in boldface denote the results achieved by the HQC.

Cell line	Best image feature	Best classifier	AUROC	Jaccard index	Dice coefficient
MDA-MD-231	Homogeneity	Quadratic discriminant analysis	0.957 ± 0.039	0.914 ± 0.083	0.953 ± 0.048
	Homogeneity	Nearest neighbors	0.956 ± 0.039	0.914 ± 0.083	0.953 ± 0.049
	Homogeneity	Linear discriminant analysis	0.955 ± 0.049	0.912 ± 0.102	0.951 ± 0.060
	Homogeneity	Gaussian Naïve Bayes	0.954 ± 0.045	0.906 ± 0.095	0.948 ± 0.056
	Homogeneity	**Helstrom quantum classifier**	**0.954 ± 0.050**	**0.910 ± 0.093**	**0.950 ± 0.055**
U87-MG	**Homogeneity**	**Helstrom quantum classifier**	**0.917 ± 0.048**	**0.794 ± 0.099**	**0.882 ± 0.062**
MCF7	$L^*u^*v^*$	Gaussian Naïve Bayes	0.969 ± 0.034	0.892 ± 0.088	0.941 ± 0.050
	$L^*u^*v^*$	Bernoulli Naïve Bayes	0.964 ± 0.030	0.844 ± 0.128	0.910 ± 0.083
	$L^*u^*v^*$	Quadratic discriminant analysis	0.961 ± 0.036	0.892 ± 0.088	0.940 ± 0.051
	$L^*u^*v^*$	Linear discriminant analysis	0.961 ± 0.047	0.899 ± 0.114	0.943 ± 0.071
	$\boldsymbol{L^*u^*v^*}$	**Helstrom quantum classifier**	**0.960 ± 0.041**	**0.869 ± 0.139**	**0.923 ± 0.097**
	$L^*u^*v^*$	SVM-linear	0.960 ± 0.052	0.894 ± 0.135	0.938 ± 0.086
U251	**Homogeneity**	**Helstrom quantum classifier**	**0.978 ± 0.027**	**0.944 ± 0.068**	**0.970 ± 0.037**
	Homogeneity	Nearest neighbors	0.978 ± 0.028	0.944 ± 0.069	0.970 ± 0.038
	Homogeneity	SVM-linear	0.978 ± 0.035	0.945 ± 0.081	0.970 ± 0.048

Table 2. The mean and standard deviation AUROC score (with respect to 30 datasets) for the best performing image feature and classifiers (up to and including HQC and classifiers whose score are tied with HQC), with corresponding mean and standard deviation Jaccard index and Dice coefficient, for cell lines MDA-MD-231, U87-MG, MCF7 and U251. The rows in boldface denote the results achieved by the HQC.

The experimental results shown in Supplementary Material S2 are summarized in Tables 1 and 2. These tables were obtained by extracting the best performing image feature and, for this image feature, the best classifier up to and including the HQC were presented. The corresponding Jaccard index and Dice coefficient values are also shown for each table.

A premise is needed. We observe the colony vs. background classification task on the datasets considered in this paper generally produces a high performance score. An explanation for this is because most of the pixels belonging to a given colony or background class are concentrated together in a large part in each of the images (see Fig. 1). Hence, the performance of most of the classifiers are generally good. For this reason, the performance for a number of classifiers will generally be quite high and the differences in the performances observed among these classifiers are very subtle. The ease of the classification task on these datasets further gives rise to the sufficient need for extracting only 0.2% samples from each of the 720 datasets used in the training pipeline of the classifiers.

The results in Tables 1, 2 and 3 (which we will discuss in more detail below) clearly show that, on average, the best performing image feature and classifier combination is given by *homogeneity* and the HQC.

For cell line MDA-MD-231, Tables S2.1.1 and S2.1.2 (see Supplementary Material S2.1) show the best image feature for both the balanced accuracy and AUROC scores is *homogeneity*. For this image feature, we can observe that the HQC was the best performing classifier for the balanced accuracy score and it was also one of the best performing classifier for the AUROC score (see Tables 1, 2). In previous work[6], we discussed the potential of the HQC achieving a higher performance is dependent upon the number of copies taken for the density patterns. In other words, increasing the number of copies increases, on average, the performance of the classifier. Consequently, the computation complexity during training increases (whereby the computational complexity is $\mathcal{O}(n^m)$), where n and m are the number of features and number of copies, respectively). In principle, a multiple-core computational platform or server would allow the HQC to achieve a higher performance which leads to potential future experiments to be explored assessing the real limits of the HQC with more powerful computing

(a) Dataset	Hyperpar. used in exp.	Hyperpar. used in exp. and rescale=0.5, encod.=amplitude, #copies=6, class weight =weighted	(b) Dataset	Hyperpar. used in exp.	Hyperpar. used in exp. and rescale=0.5 encod.=amplitude #copies=5, class weight =weighted	(c) Dataset	Hyperpar. used in exp.	Hyperpar. used in exp. and rescale=0.5, encod.=amplitude, #copies=5, class weight =weighted	(d) Dataset	Hyperpar. used in exp.	Hyperpar. used in exp. and rescale=1.0, encod.=amplitude, #copies=6, class weight=weighted
1	0.962	0.962	1	0.913	0.935	1	0.935	0.935	1	1.000	1.000
2	0.979	0.979	2	1.000	1.000	2	1.000	1.000	2	1.000	1.000
3	0.950	0.967	3	1.000	1.000	3	1.000	1.000	3	1.000	1.000
4	1.000	1.000	4	0.938	0.938	4	0.878	0.920	4	1.000	1.000
5	0.900	0.900	5	0.941	0.941	5	0.958	0.958	5	1.000	1.000
6	0.977	0.977	6	0.958	0.958	6	1.000	1.000	6	1.000	1.000
7	0.946	0.946	7	0.982	1.000	7	0.944	1.000	7	0.974	0.974
8	0.911	0.955	8	0.938	0.980	8	0.980	0.980	8	1.000	1.000
9	0.774	0.888	9	0.982	0.982	9	0.982	0.982	9	1.000	1.000
10	0.916	0.916	10	0.918	0.918	10	0.918	0.918	10	1.000	1.000
11	0.920	0.920	11	1.000	1.000	11	1.000	1.000	11	0.975	0.975
12	1.000	1.000	12	1.000	1.000	12	0.979	1.000	12	1.000	1.000
13	0.891	0.950	13	0.958	0.979	13	0.979	0.979	13	1.000	1.000
14	1.000	1.000	14	0.960	0.960	14	0.960	0.960	14	1.000	1.000
15	0.947	0.947	15	0.941	0.979	15	0.979	0.979	15	0.962	0.962
16	0.967	0.967	16	0.984	0.984	16	0.984	0.984	16	0.975	0.975
17	1.000	1.000	17	0.981	0.981	17	1.000	1.000	17	0.896	0.917
18	0.971	0.971	18	0.940	0.940	18	0.940	0.940	18	0.927	0.927
19	1.000	1.000	19	0.985	0.985	19	0.985	0.985	19	0.946	0.946
20	1.000	1.000	20	1.000	1.000	20	1.000	1.000	20	1.000	1.000
21	1.000	1.000	21	0.967	0.967	21	0.895	0.929	21	0.950	0.950
22	0.974	0.974	22	1.000	1.000	22	1.000	1.000	22	0.974	0.974
23	0.955	0.955	23	0.984	0.984	23	0.884	0.884	23	1.000	1.000
24	1.000	1.000	24	1.000	1.000	24	1.000	1.000	24	0.980	0.980
25	1.000	1.000	25	0.875	0.875	25	0.879	0.879	25	1.000	1.000
26	0.955	0.977	26	0.946	0.946	26	0.971	0.971	26	0.983	0.983
27	0.946	0.974	27	0.911	1.000	27	0.911	1.000	27	0.982	0.982
28	0.957	0.978	28	0.982	0.982	28	0.982	0.982	28	0.895	0.895
29	0.976	1.000	29	1.000	1.000	29	0.981	1.000	29	0.980	0.980
30	0.853	0.971	30	0.969	0.969	30	0.900	0.900	30	0.982	0.982
Mean	0.954	0.969	Mean	0.965	0.973	Mean	0.960	0.969	Mean	0.979	0.980

Table 3. Performance of HQC when increasing the number of copies by an addition of one copy for cases where HQC does not outperform the other classifiers. (a) For cell line MDA-MD-231, comparison of AUROC score for HQC when increasing the number of copies to 6 for 30 homogeneity image feature datasets. (b) For cell line MCF7, comparison of balance accuracy score for HQC when increasing the number of copies to 5 for 30 $L^*u^*v^*$ image feature datasets. (c) For cell line MCF7, comparison of AUROC score for HQC when increasing the number of copies to 5 for 30 $L^*u^*v^*$ image feature datasets. (d) For cell line U251, comparison of balance accuracy score for HQC when increasing the number of copies to 6 for 30 homogeneity image feature datasets.

infrastructures. Inspired by this motivation, we repeated the experiment by increasing the number of copies by an additional copy for cases where the HQC is not, initially, the best performing classifier. As an example, in Table 3a we show how by adding one more copy, the AUROC score (averaged across 30 *homogeneity* feature datasets) increases from 0.954 to 0.969, making the HQC the best performing classifier for cell line MDA-MD-231.

For cell line U87-MG, Tables S2.2.1 and S2.2.2 (see Supplementary Material S2.2) and Tables 1 and 2 show a subtle but clear supremacy of the image feature and classifier combination of *homogeneity* and the HQC, for both balanced accuracy and AUROC scores. However, it is worth noting that the balanced accuracy and AUROC scores obtained for cell line U87-MG for all classifiers (including HQC) were lower compared to the other three cell lines, indicating the classification task of discriminating a pixel being a colony or a background class to be slightly more difficult for the cell line U87-MG in comparison to the other three cell lines.

Unlike U87-MG, the balanced accuracy and AUROC scores obtained for cell line MCF7 were high, thus indicating this cell line was particularly simple to classify and naturally resulting in the comparison among the best performing classifiers more unstable. For this cell line, Tables S2.3.1 and S2.3.2 (see Supplementary Material S2.3) show the best image feature is $L^*u^*v^*$, and for this image feature, the best classifier was *Gaussian Naïve Bayes* for both the balanced accuracy and AUROC scores (see Tables 1, 2). Even though the balanced accuracy and AUROC scores obtained with the HQC were not considerably different from that of the *Gaussian Naïve Bayes*, we repeated the experiment by considering the HQC with one additional copy (using the similar procedure as described for cell line MDA-MD-231 above). In Tables 3b and 3c, we show the scores (averaged across 30 $L^*u^*v^*$ feature datasets) of the HQC obtained with the additional copy outperformed (for the balance accuracy score) and equalizes (for the AUROC score) the performance of the *Gaussian Naïve Bayes*.

Finally, for cell line U251, Tables S2.4.1 and S2.4.2 (see Supplementary Material S2.4) show the best image feature for both the balanced accuracy and AUROC scores is *homogeneity*. For this image feature, we can observe the HQC is close to (for the balance accuracy score) or is one of the best (for the AUROC score) performing classifier (see Tables 1, 2). We also note the balanced accuracy and AUROC scores obtained are high, indicating this cell line was also particularly simple to classify and naturally resulting in the comparison among the best performing classifiers more unstable. Again, we repeated the experiment for the balanced accuracy score by considering taking one more additional copy for the HQC and this gave us a further small increase of the performance of the HQC to equalize the performance of the SVM (with linear kernel) (see Table 3d).

Along the whole experiment, the calculation of the Jaccard index and the Dice coefficient confirms a good similarity of the sample sets. Moreover, in order to show how, for these clonogenic assay datasets, the 0.2% random sample extraction of the datasets is sufficiently representative, a sub-experiment was performed where the trained HQC model was tested on a new unseen test set extracted from the remaining 99.8% of the datasets. This experiment was done by randomly selecting 10 datasets (out of the 30 datasets) from the best performing image feature for each of the four cell lines. The results are shown in Tables S3.1–S3.4 (see Supplementary Material S3) where we have presented a comparison of the performance on this new unseen test set against the performance on the test set from the 0.2% random sample used in the main experiment. We could see, on average over the 10 datasets, the performance on both of these test sets is generally not considerably different, suggesting that a small training set is sufficient for the HQC to perform well on classification tasks on these type of clonogenic assay datasets. In conclusion, our results showed how the HQC is particularly efficient for the colony vs. background classification in the context of clonogenic assays. Moreover, this work gave rise to the discovery of the *homogeneity* image feature as the most informative and discriminant feature for this classification. From a biological perspective, this result represented a relevant confirmation regarding the evidence that *homogeneity*—at the phenotypic level in a radiobiology experiment—might be a very important feature to count the number of colonies in a reliable and reproducible manner and to, finally, determine the surviving fraction of the dose response curves.

Discussion and further developments

The approach proposed in this work was based on fundamental synergies between machine learning, quantum information theory and biological analysis. Overall, the achieved results are accurate and reliable. In fact, from a computational point of view, the used approach, both in terms of features and quantum-like classifier types, allowed us to obtain effective segmentation performance, with results (in particular, considering the balanced accuracy) being very similar to the reference ground-truth. The HQC being proposed, which has already shown[6] excellent performance even when compared to other quantum-like classifiers, performed well when applied to the problem at hand. Furthermore, the extracted descriptors made it possible to further improve the classifier capabilities, compared to the *RGB* and $L^*u^*v^*$ color space encodings.

From a biological point of view, the results obtained would provide support in the quantification of the well area covered by cell colonies in clonogenic survival assays. Indeed, the main problems still unsolved in a radiobiology experiment for studying the effect of a cell treatment—such as irradiation or drug administration—and quantifying the surviving cells are the high variability related to the specific cell line used, as well as the subjectivity, due to operator-dependence, in evaluation methods. Therefore, it is extremely important to use an approach that allows us to quantify the cell survival in a reliable and reproducible manner to determine the dose response curves, which represent the primary study models in radiobiology.

In the future, we plan to extend the application of the proposed classification approach, which currently provides a clonogenic assay evaluation based only on the colony area alone. We aim to integrate the developed classifier into a processing pipeline together with an *ad hoc* post-processing step allowing us to accurately quantify the number of colonies grown, as required in traditional clonogenic assay evaluations.

From the classifier's perspective, future challenges are the following: (1) develop a *pure quantum* version of the HQC (i.e., the quantum algorithm for the HQC running on quantum computers) which will enable both the advantages of a reduction in time complexity and an improvement in the accuracy at the same time, (2) investigate an optimal strategy exploiting parallel computing to allow us the use of the HQC with higher number of copies (producing a further improvement in the performance), and (3) find a multi-class generalization of the HQC (i.e., to extend the classification capability of the HQC to more than two classes). This would allow us to expand considerably the potential applications to other real-world contexts, including—but not limited to—the field of biomedical imaging.

Data availability

The software for the HQC was developed in Python and the experiment was conducted on a server with 128 GB RAM memory and 16 CPU cores. The software package is available in the public repository https://github.com/leockl/helstrom-quantum-centroid-classifier.

Received: 27 August 2020; Accepted: 15 January 2021
Published online: 02 February 2021

References

1. Biamonte, J. *et al.* Quantum machine learning. *Nature* **549**, 195–202. https://doi.org/10.1038/nature23474 (2017).
2. Schuld, M. Machine learning in quantum spaces. *Nature* **567**, 179–181. https://doi.org/10.1038/d41586-019-00771-0 (2019).

3. Schuld, M. & Petruccione, F. *Supervised Learning with Quantum Computers. Quantum Science and Technology* 1st edn. (Springer Nature, Switzerland, 2018).
4. Schuld, M., Sinayskiy, I. & Petruccione, F. An introduction to quantum machine learning. *Contemp. Phys.* **56**, 172–185. https://doi.org/10.1080/00107514.2014.964942 (2014).
5. Wittek, P. *Quantum Machine Learning: What Quantum Computing Means to Data Mining* 1st edn. (Academic Press, Cambridge, 2014).
6. Sergioli, G., Giuntini, R. & Freytes, H. A new quantum approach to binary classification. *PLoS One*https://doi.org/10.1371/journal.pone.0216224 *(2019).*
7. Sergioli, G. Quantum and quantum-like machine learning. A note on similarities and differences. *Soft Comput.*https://doi.org/10.1007/s00500-019-04429 *(2019).*
8. Manju, A. & Nigam, M. J. Applications of quantum inspired computational intelligence: A survey. *Artif. Intell. Rev.* **42**, 79–156. https://doi.org/10.1007/s10462-012-9330-6 (2014).
9. Duda, R. O., Hart, P. E. & Stork, D. G. *Pattern Classification* 2nd edn. (Wiley, Hoboken, 2000).
10. Helstrom, C. W. *Quantum Detection and Estimation Theory. Mathematics in Science and Engineering* 1st edn. (Academic Press, New York, 1976).
11. Sergioli, G. *et al.* Quantum-inspired minimum distance classification in a biomedical context. *Int. J. Quantum Inform.* **16**, 1840011. https://doi.org/10.1142/S0219749918400117 (2018).
12. Baskar, R., Dai, J., Wenlong, N., Yeo, R. & Yeoh, K.-W. Biological response of cancer cells to radiation treatment. *Front. Mol. Biosci.* **1**, 1–9. https://doi.org/10.3389/fmolb.2014.00024 (2014).
13. Minafra, L. *et al.* Radiosensitizing effect of curcumin-loaded lipid nanoparticles in breast cancer cells. *Sci. Rep.* **9**, 1–16. https://doi.org/10.1038/s41598-019-47553-2 (2019).
14. Franken, N. A. P., Rodermond, H. M., Stap, J., Haveman, J. & Van Bree, C. Clonogenic assay of cells in vitro. *Nat. Prot.* **1**, 2315. https://doi.org/10.1038/nprot.2006.339 (2006).
15. Puck, T. T. & Marcus, P. I. Action of X-rays on mammalian cells. *J. Exp. Med.* **103**, 653–666. https://doi.org/10.1084/jem.103.5.653 (1956).
16. Freshney, R. I. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications* 7th edn. (Wiley-Blackwell, New York, 2016).
17. Guzmán, C., Bagga, M., Kaur, A., Westermarck, J. & Abankwa, D. ColonyArea: An ImageJ plugin to automatically quantify colony formation in clonogenic assays. *PLoS One* **9**, e92444. https://doi.org/10.1371/journal.pone.0092444 (2014).
18. Militello, C. *et al.* Area-based cell colony surviving fraction evaluation: A novel fully automatic approach using general-purpose acquisition hardware. *Comput. Biol. Med.* **89**, 454–465. https://doi.org/10.1016/j.compbiomed.2017.08.005 (2017).
19. Militello, C. *et al.* MF2C3: Multi-feature fuzzy clustering to enhance cell colony detection in automated clonogenic assay evaluation. *Symmetry* **12**, 773. https://doi.org/10.3390/sym12050773 (2020).
20. Barber, P. R. *et al.* Automated counting of mammalian cell colonies. *Phys. Med. Biol.* **46**, 63–76. https://doi.org/10.1088/0031-9155/46/1/305 (2001).
21. Bernard, R. *et al.* Model-based automated detection of mammalian cell colonies. *Phys. Med. Biol.* **46**, 3061–3072. https://doi.org/10.1142/S02197499184001170 (2001).
22. Chiang, P.-J., Tseng, M.-J., He, Z.-S. & Li, C.-H. Automated counting of bacterial colonies by image analysis. *J. Microbiol. Methods* **108**, 74–82. https://doi.org/10.1142/S02197499184001171 (2015).
23. Dahle, J., Kakar, M., Steen, H. B. & Kaalhus, O. Automated counting of mammalian cell colonies by means of a flat bed scanner and image processing. *Cytom. Part A* **60**, 182–188. https://doi.org/10.1142/S02197499184001172 (2004).
24. Geissmann, Q. OpenCFU, a new free and open-source software to count cell colonies and other circular objects. *PLoS One* **8**, e54072. https://doi.org/10.1142/S02197499184001173 (2013).
25. Roldán Fajardo, N. *et al. A New Automatic Cancer Colony Forming Units Counting Method* (Springer, Basel, 2019).
26. Haralick, R. M. *et al.* Textural features for image classification. *IEEE Trans. Syst. Man Cybern* **SMC–3**, 610–621. https://doi.org/10.1142/S02197499184001174 (1973).
27. Haralick, R. M. Statistical and structural approaches to texture. *Proc. IEEE* **67**, 786–804. https://doi.org/10.1142/S02197499184001175 (1979).
28. Rundo, L. *et al.* HaraliCU: GPU-powered Haralick feature extraction on medical images exploiting the full dynamics of gray-scale levels. In *Parallel Computing Technologies (PaCT), vol. 11657 of LNCS* (ed. Malyshkin, V.) 304-318, (Springer, Cham, 2019) (**978-3-030-25636-4_24**).
29. Chandrashekar, G. & Sahin, F. A survey on feature selection methods. *Comput. Electr. Eng.* **40**, 16–28. https://doi.org/10.1016/j.compeleceng.2013.11.024 (2014).
30. Sun, P., Wang, D., Mok, V. C. & Shi, L. Comparison of feature selection methods and machine learning classifiers for radiomics analysis in glioma grading. *IEEE Access* **7**, 102010–102020. https://doi.org/10.1109/ACCESS.2019.2928975 (2019).
31. Wang, L. *et al.* Feature selection based on meta-heuristics for biomedicine. *Optim. Methods Softw.* **29**, 703–719. https://doi.org/10.1080/10556788.2013.834900 (2014).
32. Kohavi, R. & John, G. H. Wrappers for feature subset selection. *Artif. Intell.* **97**, 273–324. https://doi.org/10.1016/S0004-3702(97)00043-X (1997).
33. Sergioli, G., Bosyk, G. M., Santucci, E. & Giuntini, R. A quantum-inspired version of the classification problem. *Int. J. Theor. Phys.* **56**, 3880–3888. https://doi.org/10.1007/s10773-017-3371-1 (2017).
34. Lloyd, S., Mohseni, M. & Rebentrost, P. Quantum principal component analysis. *Nat. Phys.* **10**, 631–633. https://doi.org/10.1038/nphys3029 (2014).
35. Santucci, E. & Sergioli, G. Classification problem in a quantum framework. In *Quantum Foundations, Probability and Information* 215–228 (Springer, Cham, 2018). https://doi.org/10.1007/978-3-319-74971-6_16.

Acknowledgements

G.S. is grateful to Fondazione di Sardegna [project code: F71I17000330002]. R.G. is grateful to RAS (Regione autonoma della Sardegna) [project code: RASSR40341] and to Fondazione di Sardegna, project: "Resource sensitive reasoning and logic" [project code: CUP: F72F20000410007]. K.L.C. is grateful to the project PRIN 2017: "Theory and applications of resource sensitive logics" [projects code: CUP:20173WKCM5 and 20173YP4N3]. This work was also supported by the GeSeTON project Grant (funded by Italian MISE grant n. 489 of 21/02/2018) and by the PBCT PRIN (Progetti di Ricerca di Rilevante Interesse Nazionale PRIN 2017 Prot. 2017XKWWK9).

Author contributions

G.S. and C.M. (as shared first authors) conceived the experiment, analyzed the results and coordinated the research. L.R. conceived the experiment and analyzed the results. L.M. and F.T. extracted the datasets. G.R. conceived the experiment. K.L.C. conducted and analyzed the experiment. R.G. conceived and conducted the experiment. All authors reviewed the manuscript. The corresponding author is responsible for submitting a competing interests statement on behalf of all authors of the paper.

Additional information

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1038/s41598-021-82085-8.

Correspondence and requests for materials should be addressed to G.S.

Reprints and permissions information is available at www.nature.com/reprints.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

A quantum-inspired classifier for clonogenic assay evaluations - Supplementary material

Giuseppe Sergioli[1,*], Carmelo Militello[2], Leonardo Rundo[3,4], Luigi Minafra[2], Filippo Torrisi[5], Giorgio Russo[2], Keng Loon Chow[1], and Roberto Giuntini[1,6]

[1]University of Cagliari, Cagliari, Italy.
[2]Institute of Molecular Bioimaging and Physiology, Italian National Research Council, Cefalú, Palermo, Italy.
[3]Department of Radiology, University of Cambridge, Cambridge, United Kingdom.
[4]Cancer Research UK Cambridge Centre, University of Cambridge, Cambridge, United Kingdom.
[5]Department of Biomedical and Biotechnological Sciences, University of Catania, Catania, Italy.
[6]Centro Linceo Interdisciplinare "Beniamino Segre", Accademia dei Lincei, Rome, Italy.
[*]Corresponding author: giuseppe.sergioli@gmail.com

ABSTRACT

This file contains all the supplementary material regarding the experimental trials described and carried out in the manuscript "A quantum-inspired classifier for clonogenic assay evaluations". In the first section, detailed descriptions of the extracted texture features are provided. In the second section, we show the experimental results obtained for each of the four cell lines MDA-MD-231, U87-MG, MCF7, and U251, by considering the best performing image feature. The third section is devoted to show the performance of the Helstrom Quantum Classifier (HQC) on a new unseen test set. Finally, in the last section we summarize the full results of the whole experiment, for all the investigated cell lines and image features.

S1. The extracted Haralick's features

We start from the assumption that biomedical images contain information phenotype of the underlying physiopathology, which is not always easily identifiable by simple 'visual' inspection. These information can be revealed through quantitative analysis, by extracting the so called 'descriptors' in order to make it possible to acquire further knowledge on the dominion. The Gray-Level Co-occurrence Matrix (GLCM) computation is the first step to obtain the features.

Formally, let a GLCM with size $L \times L$, where L represents the maximum number of gray-levels according to a given quantization scheme, denote the second-order joint probability function $p(i,j)$ of an image region (where $i,j \in [0,1,\ldots,L-1]$ represent a gray-level pair) after the normalization by the total number of pixels. These descriptors are generally called Haralick's features[1,2].

Given a squared window of size $\omega \times \omega$ pixels sliding over the whole image[3], we computed the following GLCM-based features (with $i,j \in [0,1,\ldots,L-1]$):

- contrast $\in [0,(L-1)\times(L-1)$ yields a measure of the intensity contrast between neighboring pixels:

$$\mathsf{contrast}(i,j) = \sum_{i=0}^{L-1}\sum_{j=0}^{L-1} |i-j|^2 \cdot p(i,j), \tag{1}$$

  contrast $= 0$ for a constant image;

- correlation $\in [-1,1]$ indicates the degree of correlation between a pixel and its neighbor:

$$\mathsf{correlation}(i,j) = \frac{\sum_{i=0}^{L-1}\sum_{j=0}^{L-1}(i-\mu_x)(j-\mu_y)\cdot p_(i,j)}{\sigma_x\sigma_y}, \tag{2}$$

  where: $\mu_x = \sum_i\sum_j i \cdot p(i,j)$, $\mu_y = \sum_i\sum_j j \cdot p(i,j)$, $\sigma_x = \sum_i\sum_j (i-\mu_x)\cdot p(i,j)$, and $\sigma_y = \sum_i\sum_j (j-\mu_y)\cdot p(i,j)$ (with $\sum_i$ and $\sum_j$ denoting $\sum_{i=0}^{L-1}$ and $\sum_{j=0}^{L-1}$, respectively). This feature is 1 or -1 for a perfectly positively or negatively correlated image, respectively;

- energy $\in [0,1]$ calculates the sum of squared elements in the GLCM:

$$\text{energy}(i,j) = \sum_{i=0}^{L-1}\sum_{j=0}^{L-1} p(i,j)^2, \tag{3}$$

energy $= 1$ for a constant image;

- homogeneity $\in [0,1]$ Returns a value that measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal:

$$\text{homogeneity}(i,j) = \frac{\sum_{i=0}^{L-1}\sum_{j=0}^{L-1} p(i,j)}{(1+|i-j|)}, \tag{4}$$

homogeneity $= 1$ for a diagonal GLCM.

S2. Experimental results

This section is divided into four groups, one for each cell line MDA-MD-231, U87-MG, MCF7 and U251, respectively. Each group contains two reports, the first shows: (1) the balanced accuracy score over 30 datasets (for the best performing image feature) for the HQC and the 18 competing classifiers, obtained by hypertuning the hyperparameters of each classifier in order to optimize the balanced accuracy score; (2) heatmaps of a classifier outperforming ("wins") over another classifier ("losses") out of the 30 datasets (for the best performing image feature); and (3) a table showing the averaged balanced accuracy score over the 30 datasets for each of the six image features, *RGB*, *L*u*v**, *contrast*, *correlation*, *energy* and *homogeneity*. The second report is the analogous of the first, where the role of the balanced accuracy is replaced by the AUROC score. All performance evaluation is performed using the test set. The aim of the experimental procedure is to find the most informative image feature in discriminating a pixel between a colony or a background, i.e., the image feature which maximizes the value of the balanced accuracy and the AUROC scores, respectively.

S2.1. Cell line MDA-MD-231

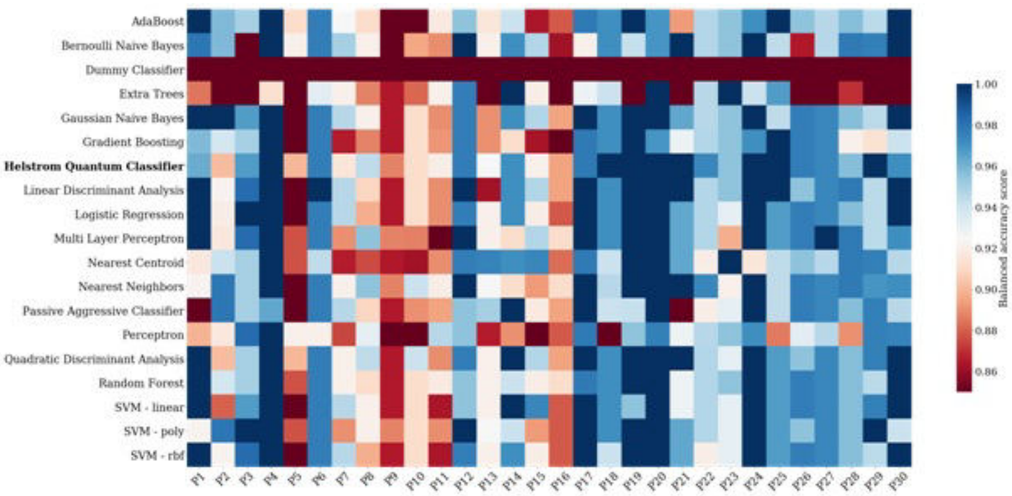

Fig. 2.1.1 | Balance accuracy score of 19 classifiers across 30 homogeneity image feature datasets for cell line MDA-MD-231.

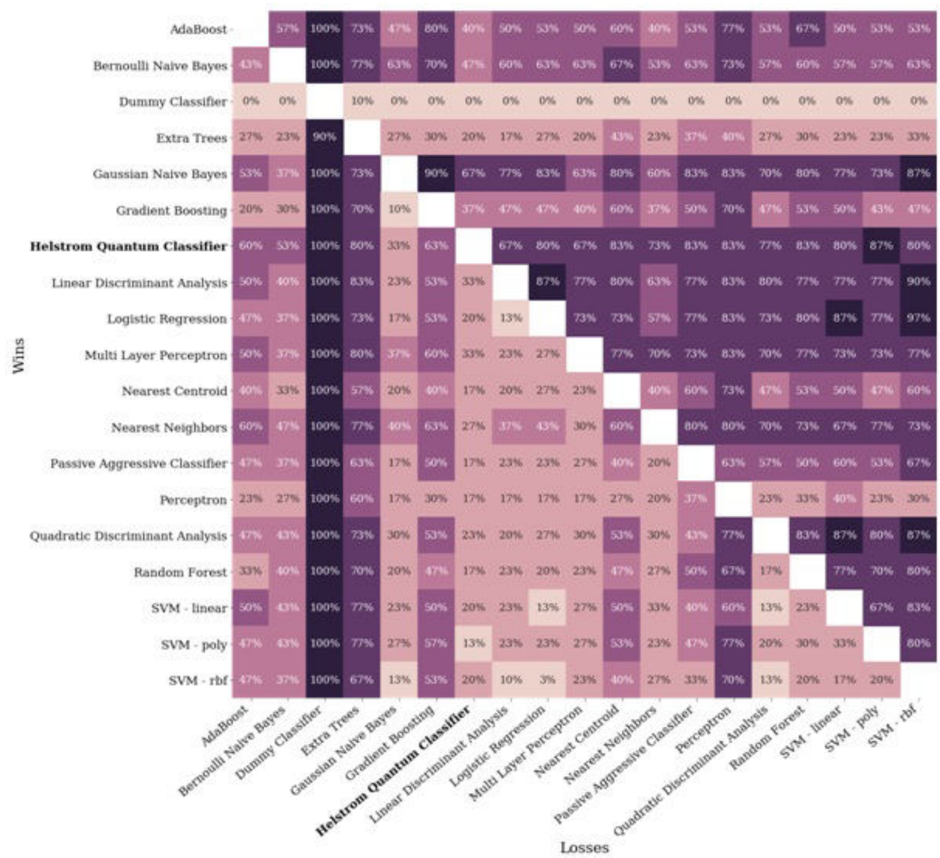

Fig. 2.1.2 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 homogeneity image feature datasets for cell line MDA-MD-231 (balanced accuracy score).

Table 2.1.1 | The mean and standard deviation balanced accuracy score (with respect to 30 datasets) for cell line MDA-MD-231

	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.861 ± 0.088	0.878 ± 0.065	0.898 ± 0.065	0.738 ± 0.110	0.936 ± 0.052	0.942 ± 0.046
Bernoulli Naive Bayes	0.841 ± 0.060	0.855 ± 0.079	0.840 ± 0.097	0.630 ± 0.126	0.854 ± 0.087	0.940 ± 0.057
Dummy Classifier	0.507 ± 0.047	0.513 ± 0.056	0.506 ± 0.069	0.518 ± 0.042	0.497 ± 0.069	0.485 ± 0.060
Extra Trees	0.822 ± 0.120	0.839 ± 0.141	0.709 ± 0.163	0.616 ± 0.121	0.767 ± 0.169	0.851 ± 0.139
Gaussian Naive Bayes	0.855 ± 0.063	0.874 ± 0.084	0.886 ± 0.063	0.711 ± 0.102	0.923 ± 0.067	0.954 ± 0.045
Gradient Boosting	0.876 ± 0.076	0.874 ± 0.069	0.899 ± 0.063	0.835 ± 0.113	0.941 ± 0.047	0.933 ± 0.050
Helstrom Quantum Classifier	0.895 ± 0.058	0.883 ± 0.069	0.902 ± 0.070	0.775 ± 0.081	0.938 ± 0.047	**0.959 ± 0.036**
Linear Discriminant Analysis	0.850 ± 0.066	0.865 ± 0.080	0.837 ± 0.075	0.660 ± 0.122	0.860 ± 0.089	0.955 ± 0.049
Logistic Regression	0.882 ± 0.061	0.879 ± 0.086	0.883 ± 0.066	0.657 ± 0.131	0.932 ± 0.056	0.951 ± 0.045
Multi Layer Perceptron	0.890 ± 0.055	0.885 ± 0.069	0.901 ± 0.069	0.833 ± 0.086	0.942 ± 0.052	0.940 ± 0.091
Nearest Centroid	0.839 ± 0.058	0.868 ± 0.078	0.846 ± 0.070	0.686 ± 0.114	0.867 ± 0.063	0.941 ± 0.044
Nearest Neighbors	0.890 ± 0.069	0.875 ± 0.064	0.903 ± 0.073	0.808 ± 0.070	0.942 ± 0.049	0.953 ± 0.040
Passive Aggressive Classifier	0.831 ± 0.105	0.809 ± 0.113	0.828 ± 0.118	0.607 ± 0.137	0.907 ± 0.062	0.935 ± 0.052
Perceptron	0.790 ± 0.117	0.832 ± 0.106	0.831 ± 0.112	0.631 ± 0.103	0.914 ± 0.054	0.916 ± 0.060
Quadratic Discriminant Analysis	0.872 ± 0.065	0.876 ± 0.074	0.876 ± 0.076	0.731 ± 0.112	0.925 ± 0.066	0.957 ± 0.039
Random Forest	0.874 ± 0.078	0.883 ± 0.074	0.919 ± 0.058	0.827 ± 0.119	0.944 ± 0.043	0.951 ± 0.036
SVM - linear	0.880 ± 0.063	0.873 ± 0.078	0.880 ± 0.071	0.655 ± 0.141	0.929 ± 0.052	0.949 ± 0.046
SVM - poly	0.883 ± 0.055	0.892 ± 0.069	0.899 ± 0.065	0.811 ± 0.084	0.926 ± 0.050	0.950 ± 0.042
SVM - rbf	0.876 ± 0.062	0.874 ± 0.084	0.890 ± 0.069	0.662 ± 0.134	0.931 ± 0.052	0.948 ± 0.046

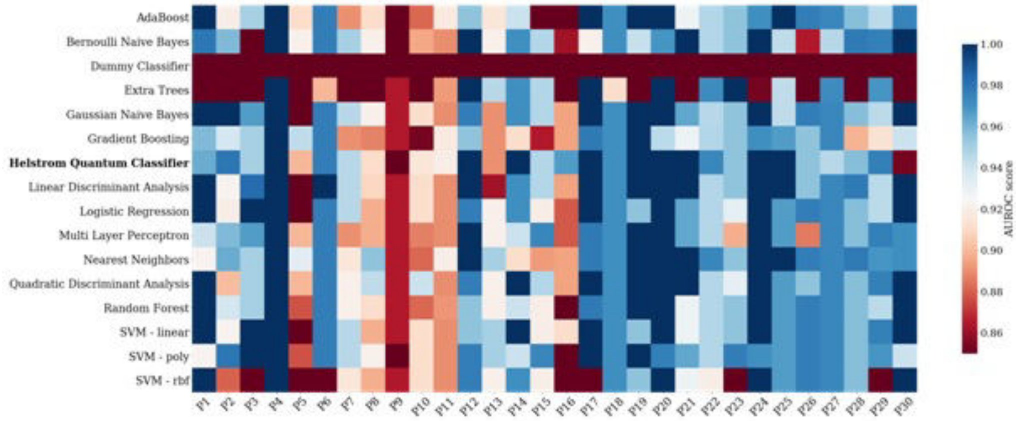

Fig. 2.1.3 | AUROC score of 19 classifiers across 30 homogeneity image feature datasets for cell line MDA-MD-231.

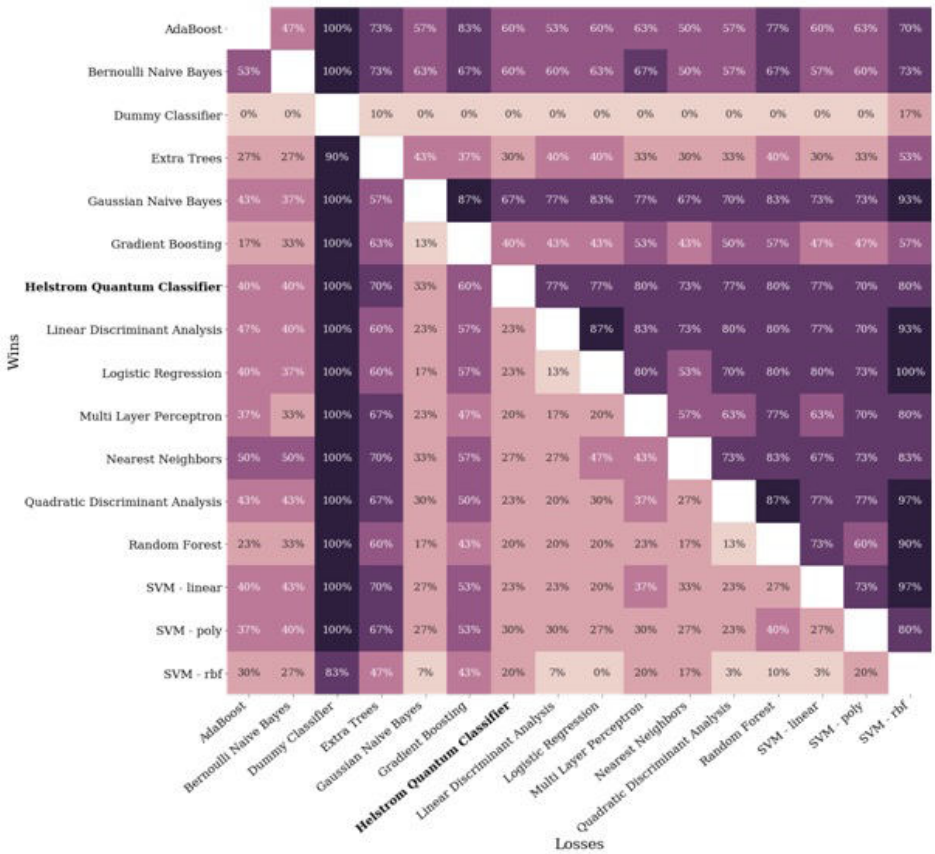

Fig. 2.1.4 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 homogeneity image feature datasets for cell line MDA-MD-231 (AUROC score).

Table 2.1.2 | The mean and standard deviation AUROC score (with respect to 30 datasets) for cell line MDA-MD-231						
	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.874 ± 0.076	0.881 ± 0.067	0.898 ± 0.063	0.739 ± 0.130	0.932 ± 0.051	0.943 ± 0.048
Bernoulli Naive Bayes	0.841 ± 0.060	0.855 ± 0.079	0.840 ± 0.097	0.630 ± 0.126	0.854 ± 0.087	0.940 ± 0.057
Dummy Classifier	0.505 ± 0.027	0.498 ± 0.072	0.484 ± 0.046	0.497 ± 0.070	0.503 ± 0.077	0.497 ± 0.049
Extra Trees	0.813 ± 0.132	0.812 ± 0.159	0.678 ± 0.162	0.615 ± 0.127	0.740 ± 0.178	0.837 ± 0.159
Gaussian Naive Bayes	0.855 ± 0.063	0.874 ± 0.084	0.886 ± 0.063	0.711 ± 0.102	0.923 ± 0.067	0.954 ± 0.045
Gradient Boosting	0.880 ± 0.074	0.868 ± 0.076	0.902 ± 0.066	0.834 ± 0.114	0.930 ± 0.056	0.935 ± 0.039
Helstrom Quantum Classifier	0.879 ± 0.081	0.884 ± 0.066	0.905 ± 0.062	0.787 ± 0.082	0.927 ± 0.058	**0.954 ± 0.050**
Linear Discriminant Analysis	0.850 ± 0.066	0.865 ± 0.080	0.837 ± 0.075	0.660 ± 0.122	0.860 ± 0.089	0.955 ± 0.049
Logistic Regression	0.872 ± 0.072	0.874 ± 0.088	0.886 ± 0.068	0.660 ± 0.138	0.927 ± 0.051	0.950 ± 0.044
Multi Layer Perceptron	0.889 ± 0.056	0.889 ± 0.057	0.894 ± 0.065	0.804 ± 0.104	0.932 ± 0.041	0.946 ± 0.042
Nearest Neighbors	0.883 ± 0.070	0.877 ± 0.066	0.902 ± 0.064	0.800 ± 0.075	0.937 ± 0.049	0.956 ± 0.039
Quadratic Discriminant Analysis	0.872 ± 0.065	0.876 ± 0.074	0.876 ± 0.076	0.731 ± 0.112	0.925 ± 0.066	0.957 ± 0.039
Random Forest	0.881 ± 0.068	0.878 ± 0.077	0.912 ± 0.062	0.817 ± 0.117	0.943 ± 0.040	0.946 ± 0.043
SVM - linear	0.879 ± 0.064	0.876 ± 0.076	0.881 ± 0.073	0.648 ± 0.135	0.914 ± 0.049	0.953 ± 0.043
SVM - poly	0.880 ± 0.058	0.864 ± 0.082	0.897 ± 0.064	0.805 ± 0.087	0.920 ± 0.052	0.950 ± 0.047
SVM - rbf	0.845 ± 0.115	0.860 ± 0.104	0.831 ± 0.147	0.652 ± 0.132	0.879 ± 0.138	0.843 ± 0.193

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

S2.2. Cell line U87-MG

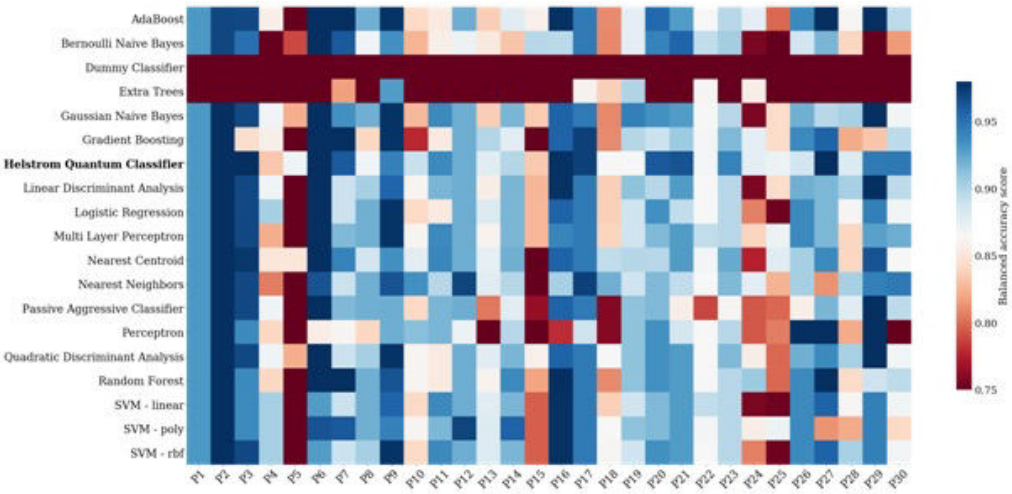

Fig. 2.2.1 | Balance accuracy score of 19 classifiers across 30 homogeneity image feature datasets for cell line U87-MG.

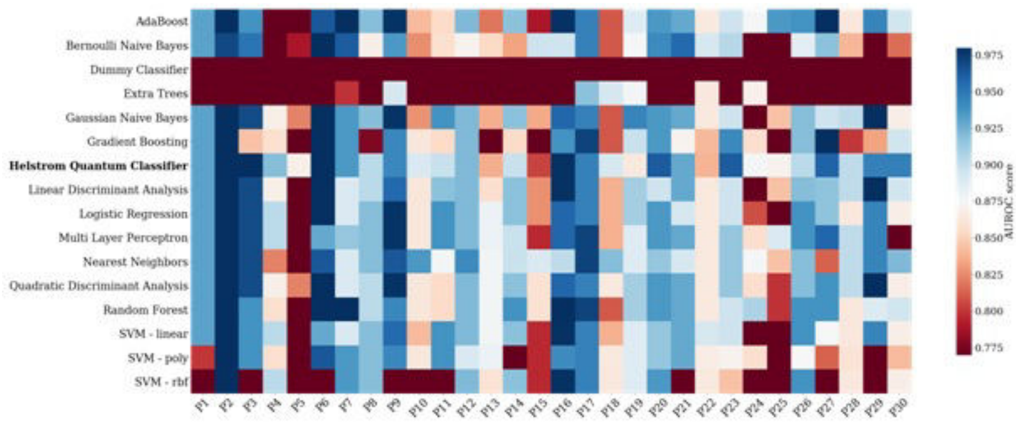

Fig. 2.2.3 | **AUROC score of 19 classifiers across 30 homogeneity image feature datasets for cell line U87-MG.**

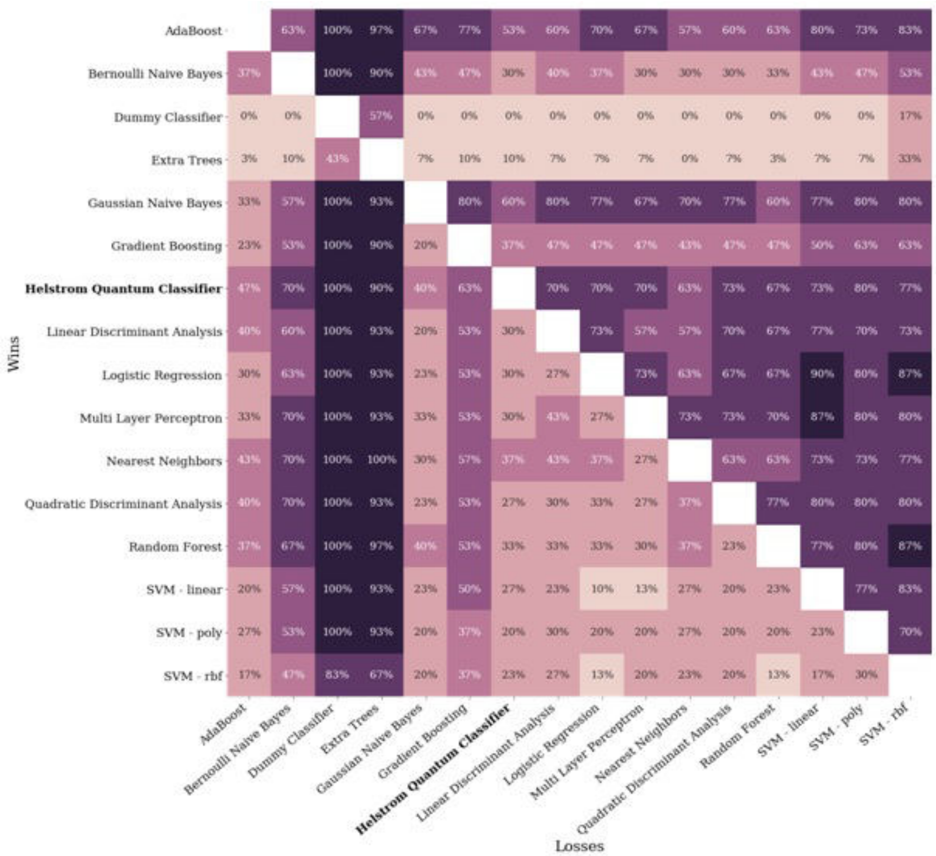

Fig. 2.2.4 | **Percentage of datasets where model A (“Wins”) outperformed model B (“Losses”) out of 30 homogeneity image feature datasets for cell line U87-MG (AUROC score).**

Table 2.2.2 | The mean and standard deviation AUROC score (with respect to 30 datasets) for cell line U87-MG

	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.776 ± 0.117	0.779 ± 0.110	0.864 ± 0.060	0.704 ± 0.105	0.873 ± 0.082	0.898 ± 0.077
Bernoulli Naive Bayes	0.765 ± 0.095	0.788 ± 0.084	0.841 ± 0.070	0.629 ± 0.088	0.771 ± 0.126	0.869 ± 0.082
Dummy Classifier	0.504 ± 0.050	0.504 ± 0.056	0.512 ± 0.055	0.480 ± 0.076	0.505 ± 0.055	0.516 ± 0.058
Extra Trees	0.577 ± 0.098	0.583 ± 0.120	0.529 ± 0.078	0.515 ± 0.043	0.525 ± 0.068	0.613 ± 0.156
Gaussian Naive Bayes	0.734 ± 0.089	0.752 ± 0.096	0.780 ± 0.086	0.674 ± 0.074	0.890 ± 0.065	0.905 ± 0.059
Gradient Boosting	0.815 ± 0.091	0.827 ± 0.085	0.877 ± 0.064	0.758 ± 0.095	0.879 ± 0.075	0.871 ± 0.085
Helstrom Quantum Classifier	0.791 ± 0.099	0.792 ± 0.090	0.838 ± 0.066	0.768 ± 0.075	0.902 ± 0.057	**0.917 ± 0.048**
Linear Discriminant Analysis	0.752 ± 0.095	0.736 ± 0.085	0.740 ± 0.076	0.639 ± 0.086	0.842 ± 0.107	0.900 ± 0.065
Logistic Regression	0.770 ± 0.100	0.764 ± 0.102	0.805 ± 0.085	0.636 ± 0.086	0.877 ± 0.071	0.897 ± 0.070
Multi Layer Perceptron	0.792 ± 0.109	0.784 ± 0.115	0.840 ± 0.067	0.768 ± 0.079	0.877 ± 0.099	0.901 ± 0.070
Nearest Neighbors	0.793 ± 0.105	0.793 ± 0.090	0.847 ± 0.044	0.739 ± 0.086	0.884 ± 0.076	0.902 ± 0.054
Quadratic Discriminant Analysis	0.773 ± 0.100	0.750 ± 0.102	0.782 ± 0.100	0.667 ± 0.074	0.879 ± 0.081	0.908 ± 0.050
Random Forest	0.808 ± 0.106	0.803 ± 0.100	0.861 ± 0.059	0.763 ± 0.083	0.900 ± 0.070	0.902 ± 0.068
SVM - linear	0.764 ± 0.100	0.751 ± 0.113	0.798 ± 0.088	0.591 ± 0.103	0.891 ± 0.065	0.888 ± 0.076
SVM - poly	0.745 ± 0.119	0.746 ± 0.111	0.780 ± 0.084	0.720 ± 0.091	0.865 ± 0.095	0.864 ± 0.090
SVM - rbf	0.756 ± 0.123	0.741 ± 0.114	0.682 ± 0.157	0.575 ± 0.096	0.859 ± 0.130	0.770 ± 0.179

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

S2.3. Cell line MCF7

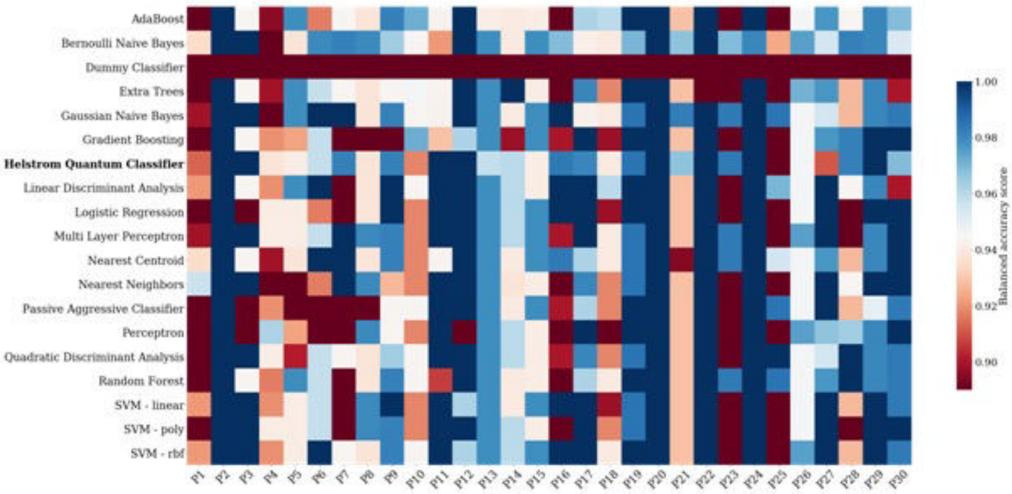

Fig. 2.3.1 | Balance accuracy score of 19 classifiers across 30 L*u*v* image feature datasets for cell line MCF7.

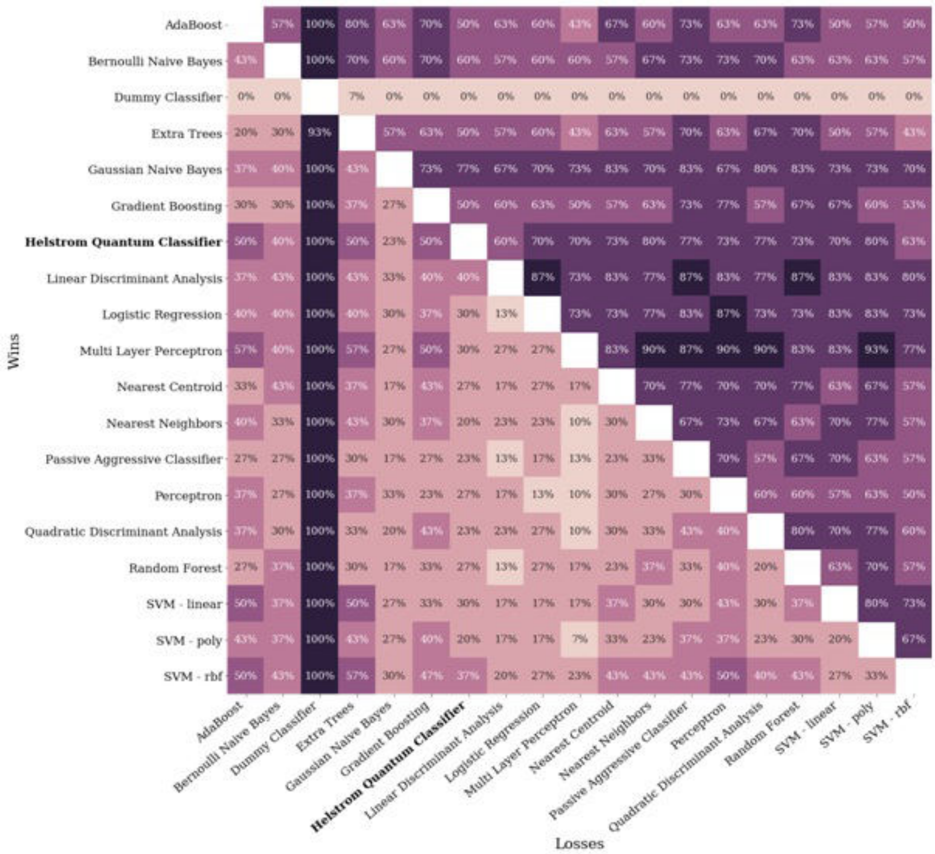

Fig. 2.3.2 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 L*u*v* image feature datasets for cell line MCF7 (balanced accuracy score).

Table 2.3.1 | The mean and standard deviation balanced accuracy score (with respect to 30 datasets) for cell line MCF7

	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.959 ± 0.046	0.940 ± 0.070	0.827 ± 0.106	0.699 ± 0.099	0.851 ± 0.111	0.875 ± 0.092
Bernoulli Naive Bayes	0.951 ± 0.048	0.964 ± 0.030	0.717 ± 0.124	0.661 ± 0.107	0.718 ± 0.133	0.837 ± 0.118
Dummy Classifier	0.505 ± 0.064	0.509 ± 0.041	0.494 ± 0.048	0.484 ± 0.044	0.500 ± 0.057	0.491 ± 0.044
Extra Trees	0.858 ± 0.150	0.914 ± 0.125	0.507 ± 0.037	0.526 ± 0.061	0.523 ± 0.078	0.585 ± 0.124
Gaussian Naive Bayes	0.943 ± 0.043	0.969 ± 0.034	0.641 ± 0.095	0.715 ± 0.091	0.886 ± 0.069	0.882 ± 0.078
Gradient Boosting	0.934 ± 0.080	0.939 ± 0.062	0.814 ± 0.103	0.706 ± 0.088	0.844 ± 0.093	0.866 ± 0.110
Helstrom Quantum Classifier	0.949 ± 0.052	**0.965 ± 0.033**	0.798 ± 0.109	0.775 ± 0.081	0.875 ± 0.059	0.892 ± 0.065
Linear Discriminant Analysis	0.947 ± 0.047	0.961 ± 0.047	0.626 ± 0.097	0.685 ± 0.098	0.781 ± 0.139	0.874 ± 0.095
Logistic Regression	0.946 ± 0.055	0.948 ± 0.060	0.638 ± 0.107	0.674 ± 0.095	0.866 ± 0.097	0.856 ± 0.096
Multi Layer Perceptron	0.946 ± 0.052	0.965 ± 0.042	0.760 ± 0.106	0.718 ± 0.089	0.867 ± 0.089	0.856 ± 0.111
Nearest Centroid	0.923 ± 0.056	0.964 ± 0.032	0.770 ± 0.117	0.739 ± 0.095	0.851 ± 0.068	0.890 ± 0.063
Nearest Neighbors	0.951 ± 0.056	0.947 ± 0.063	0.769 ± 0.109	0.759 ± 0.075	0.861 ± 0.075	0.854 ± 0.101
Passive Aggressive Classifier	0.945 ± 0.048	0.943 ± 0.051	0.690 ± 0.120	0.616 ± 0.145	0.787 ± 0.145	0.770 ± 0.154
Perceptron	0.938 ± 0.056	0.923 ± 0.094	0.652 ± 0.167	0.630 ± 0.145	0.774 ± 0.122	0.795 ± 0.149
Quadratic Discriminant Analysis	0.959 ± 0.050	0.961 ± 0.036	0.638 ± 0.096	0.710 ± 0.111	0.883 ± 0.072	0.872 ± 0.089
Random Forest	0.948 ± 0.064	0.956 ± 0.044	0.816 ± 0.112	0.740 ± 0.097	0.851 ± 0.113	0.860 ± 0.110
SVM - linear	0.955 ± 0.050	0.956 ± 0.052	0.654 ± 0.138	0.696 ± 0.107	0.868 ± 0.110	0.873 ± 0.108
SVM - poly	0.940 ± 0.054	0.949 ± 0.060	0.762 ± 0.108	0.730 ± 0.080	0.862 ± 0.078	0.874 ± 0.105
SVM - rbf	0.950 ± 0.053	0.962 ± 0.048	0.681 ± 0.134	0.697 ± 0.108	0.868 ± 0.112	0.877 ± 0.102

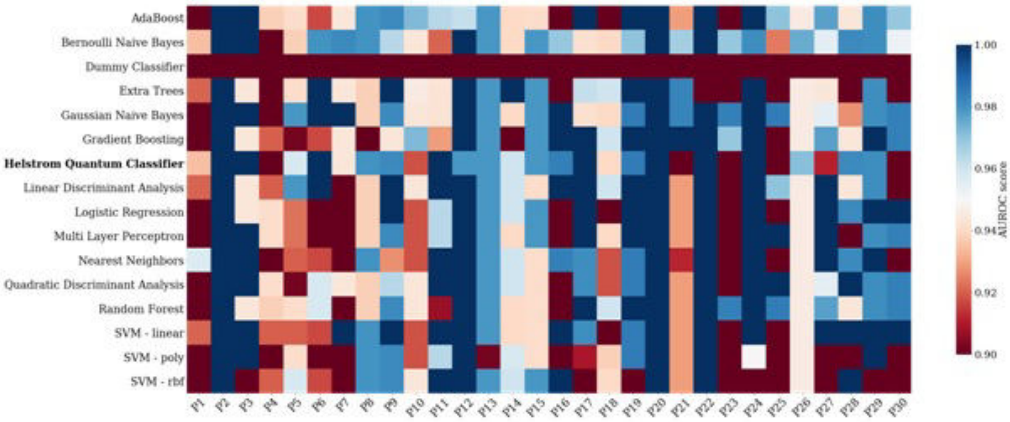

Fig. 2.3.3 | AUROC score of 19 classifiers across 30 L*u*v* image feature datasets for cell line MCF7.

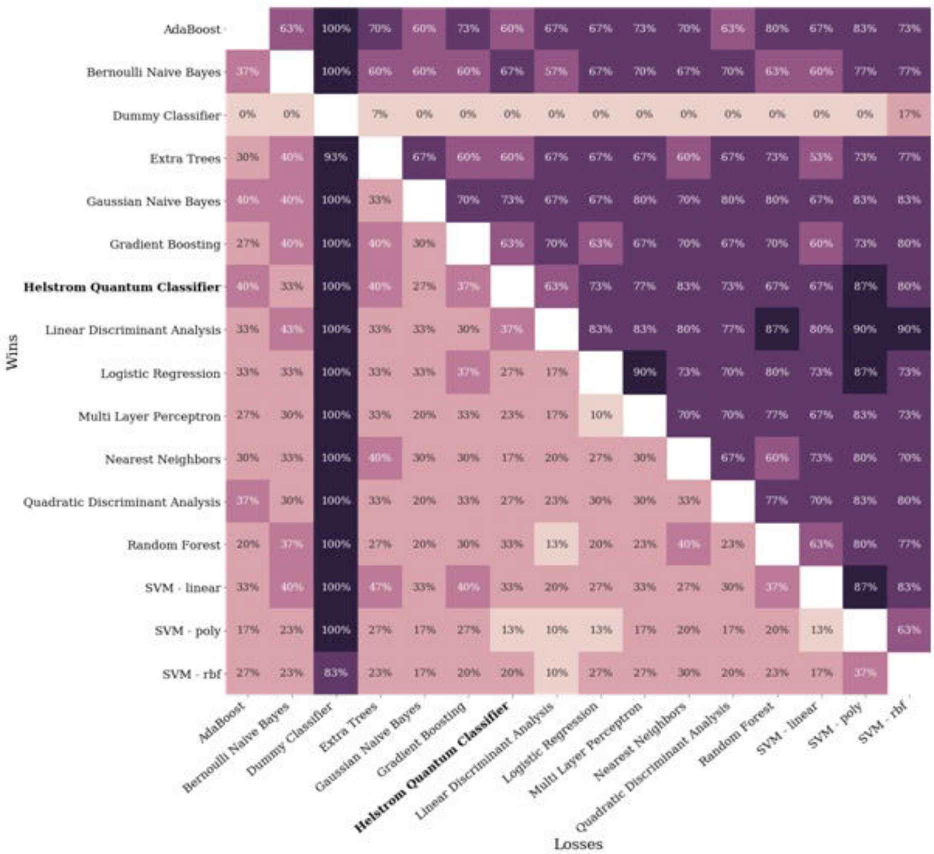

Fig. 2.3.4 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 L*u*v* image feature datasets for cell line MCF7 (AUROC score).

Table 2.3.2 | The mean and standard deviation AUROC score (with respect to 30 datasets) for cell line MCF7						
	Image features					
Classifiers	RGB	L*u*v*	Contrast	Correlation	Energy	Homogeneity
AdaBoost	0.944 ± 0.076	0.951 ± 0.058	0.821 ± 0.110	0.704 ± 0.107	0.845 ± 0.103	0.857 ± 0.102
Bernoulli Naive Bayes	0.951 ± 0.048	0.964 ± 0.030	0.717 ± 0.124	0.661 ± 0.107	0.718 ± 0.133	0.837 ± 0.118
Dummy Classifier	0.475 ± 0.066	0.506 ± 0.073	0.504 ± 0.041	0.506 ± 0.051	0.496 ± 0.069	0.493 ± 0.051
Extra Trees	0.856 ± 0.148	0.918 ± 0.129	0.505 ± 0.025	0.511 ± 0.038	0.509 ± 0.043	0.527 ± 0.068
Gaussian Naive Bayes	0.943 ± 0.043	0.969 ± 0.034	0.641 ± 0.095	0.715 ± 0.091	0.886 ± 0.069	0.882 ± 0.078
Gradient Boosting	0.911 ± 0.112	0.952 ± 0.060	0.773 ± 0.121	0.719 ± 0.091	0.820 ± 0.092	0.837 ± 0.117
Helstrom Quantum Classifier	0.955 ± 0.045	**0.960 ± 0.041**	0.753 ± 0.120	0.766 ± 0.090	0.866 ± 0.078	0.883 ± 0.071
Linear Discriminant Analysis	0.947 ± 0.047	0.961 ± 0.047	0.626 ± 0.096	0.685 ± 0.098	0.780 ± 0.141	0.874 ± 0.095
Logistic Regression	0.943 ± 0.062	0.950 ± 0.054	0.637 ± 0.108	0.672 ± 0.095	0.853 ± 0.115	0.848 ± 0.107
Multi Layer Perceptron	0.953 ± 0.056	0.950 ± 0.054	0.770 ± 0.120	0.700 ± 0.103	0.850 ± 0.082	0.869 ± 0.104
Nearest Neighbors	0.948 ± 0.045	0.947 ± 0.061	0.767 ± 0.115	0.751 ± 0.087	0.862 ± 0.080	0.850 ± 0.110
Quadratic Discriminant Analysis	0.959 ± 0.050	0.961 ± 0.036	0.638 ± 0.096	0.710 ± 0.111	0.883 ± 0.072	0.872 ± 0.089
Random Forest	0.949 ± 0.066	0.953 ± 0.057	0.811 ± 0.116	0.733 ± 0.100	0.838 ± 0.133	0.852 ± 0.104
SVM - linear	0.946 ± 0.054	0.960 ± 0.052	0.635 ± 0.135	0.687 ± 0.113	0.849 ± 0.126	0.858 ± 0.130
SVM - poly	0.887 ± 0.093	0.927 ± 0.063	0.713 ± 0.125	0.682 ± 0.113	0.841 ± 0.107	0.866 ± 0.121
SVM - rbf	0.872 ± 0.144	0.859 ± 0.176	0.586 ± 0.111	0.601 ± 0.121	0.839 ± 0.142	0.717 ± 0.200

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

S2.4. Cell line U251

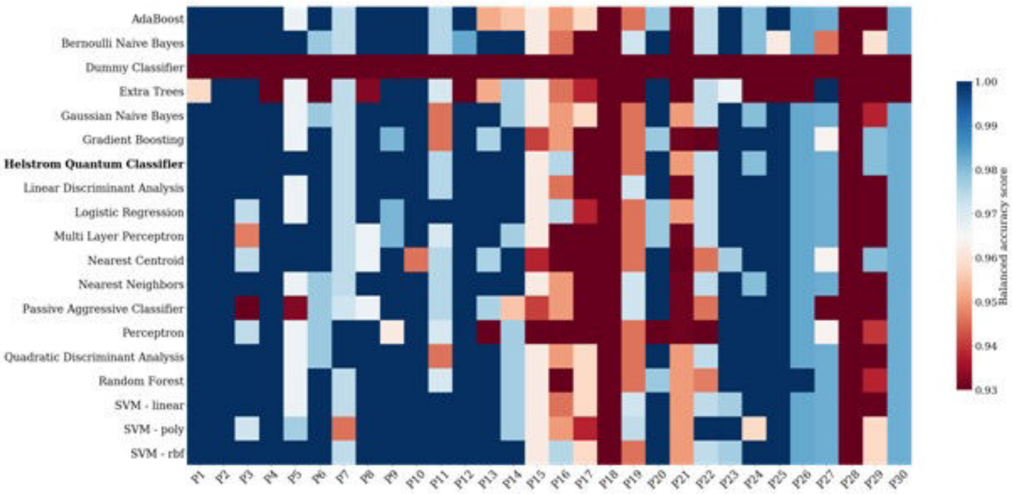

Fig. 2.4.1 | Balance accuracy score of 19 classifiers across 30 homogeneity image feature datasets for cell line U251.

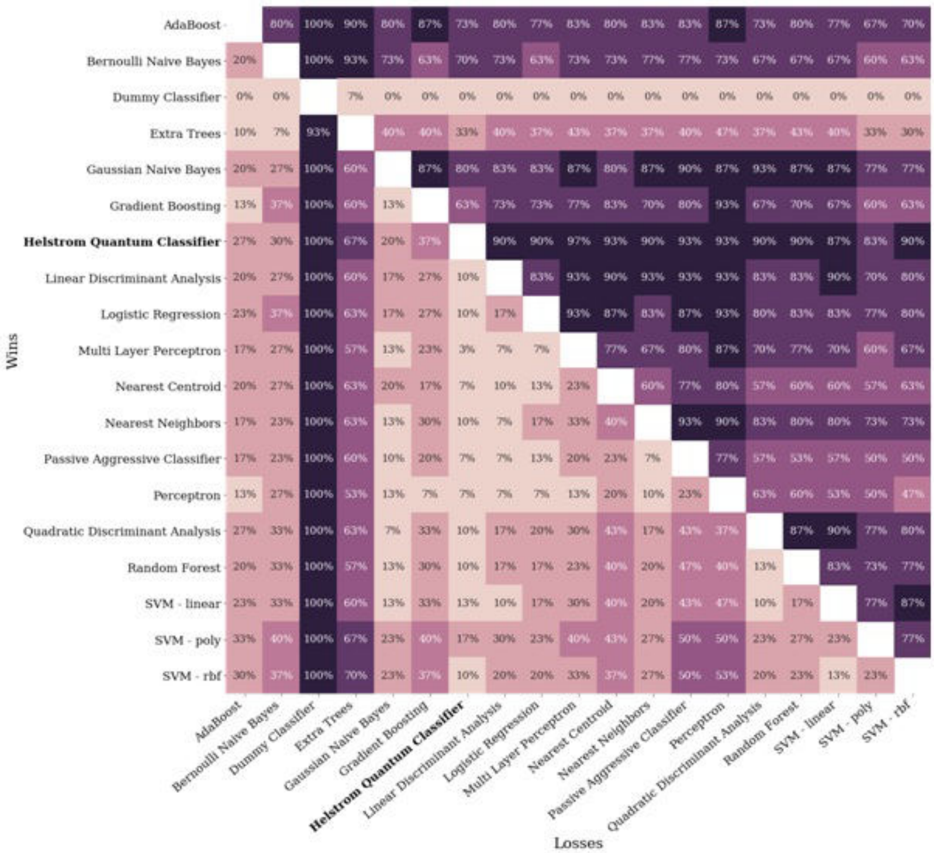

Fig. 2.4.2 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 homogeneity image feature datasets for cell line U251 (balanced accuracy score).

Table 2.4.1 | The mean and standard deviation balanced accuracy score (with respect to 30 datasets) for cell line U251

	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.911 ± 0.049	0.909 ± 0.046	0.969 ± 0.027	0.771 ± 0.081	0.968 ± 0.045	0.972 ± 0.032
Bernoulli Naive Bayes	0.890 ± 0.047	0.903 ± 0.043	0.934 ± 0.055	0.649 ± 0.108	0.859 ± 0.118	0.967 ± 0.059
Dummy Classifier	0.504 ± 0.068	0.494 ± 0.058	0.495 ± 0.049	0.485 ± 0.057	0.495 ± 0.051	0.509 ± 0.069
Extra Trees	0.832 ± 0.126	0.865 ± 0.098	0.714 ± 0.188	0.571 ± 0.110	0.692 ± 0.206	0.867 ± 0.164
Gaussian Naive Bayes	0.908 ± 0.052	0.912 ± 0.051	0.969 ± 0.030	0.698 ± 0.084	0.964 ± 0.033	0.976 ± 0.027
Gradient Boosting	0.917 ± 0.049	0.907 ± 0.054	0.958 ± 0.034	0.845 ± 0.064	0.965 ± 0.039	0.970 ± 0.035
Helstrom Quantum Classifier	0.917 ± 0.045	0.907 ± 0.039	0.966 ± 0.032	0.792 ± 0.070	0.973 ± 0.024	**0.979 ± 0.029**
Linear Discriminant Analysis	0.892 ± 0.062	0.904 ± 0.047	0.916 ± 0.065	0.674 ± 0.087	0.935 ± 0.058	0.975 ± 0.036
Logistic Regression	0.911 ± 0.051	0.918 ± 0.044	0.965 ± 0.030	0.677 ± 0.087	0.964 ± 0.031	0.976 ± 0.031
Multi Layer Perceptron	0.915 ± 0.045	0.924 ± 0.046	0.965 ± 0.035	0.837 ± 0.087	0.968 ± 0.034	0.969 ± 0.035
Nearest Centroid	0.892 ± 0.051	0.892 ± 0.048	0.927 ± 0.033	0.694 ± 0.091	0.923 ± 0.048	0.967 ± 0.038
Nearest Neighbors	0.914 ± 0.046	0.907 ± 0.050	0.969 ± 0.032	0.836 ± 0.078	0.974 ± 0.036	0.974 ± 0.033
Passive Aggressive Classifier	0.875 ± 0.070	0.881 ± 0.070	0.951 ± 0.050	0.575 ± 0.111	0.958 ± 0.047	0.959 ± 0.046
Perceptron	0.902 ± 0.054	0.889 ± 0.060	0.945 ± 0.060	0.586 ± 0.117	0.951 ± 0.039	0.952 ± 0.056
Quadratic Discriminant Analysis	0.923 ± 0.053	0.924 ± 0.051	0.972 ± 0.028	0.712 ± 0.085	0.969 ± 0.033	0.976 ± 0.028
Random Forest	0.926 ± 0.048	0.918 ± 0.047	0.973 ± 0.033	0.815 ± 0.086	0.970 ± 0.044	0.974 ± 0.034
SVM - linear	0.916 ± 0.047	0.914 ± 0.051	0.970 ± 0.027	0.656 ± 0.103	0.975 ± 0.028	0.976 ± 0.035
SVM - poly	0.925 ± 0.052	0.911 ± 0.064	0.972 ± 0.027	0.821 ± 0.072	0.970 ± 0.031	0.978 ± 0.025
SVM - rbf	0.913 ± 0.051	0.917 ± 0.053	0.969 ± 0.032	0.667 ± 0.100	0.976 ± 0.027	0.980 ± 0.033

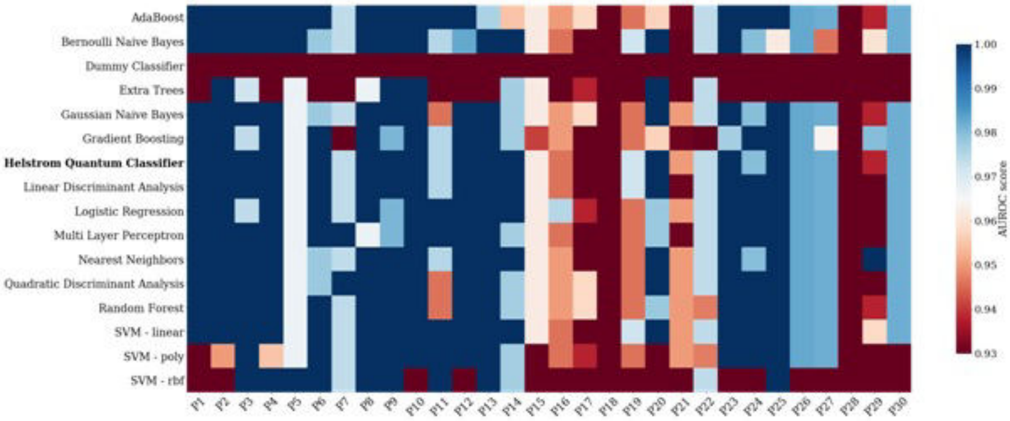

Fig. 2.4.3 | AUROC score of 19 classifiers across 30 homogeneity image feature datasets for cell line U251.

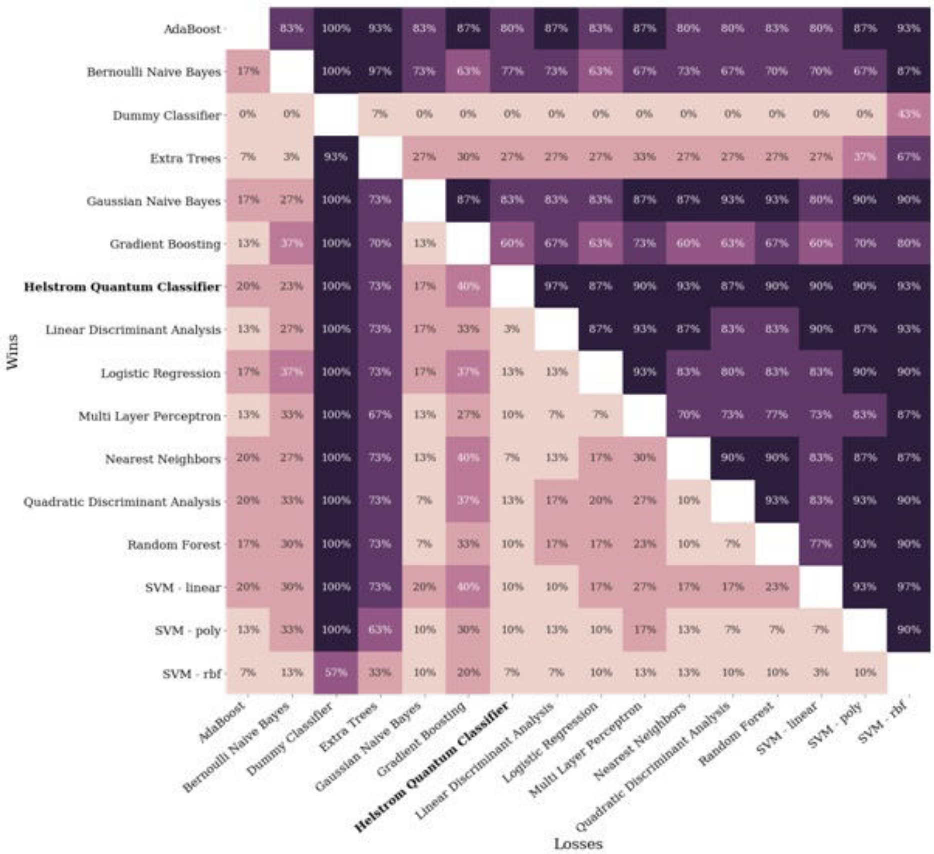

Fig. 2.4.4 | Percentage of datasets where model A ("Wins") outperformed model B ("Losses") out of 30 homogeneity image feature datasets for cell line U251 (AUROC score).

Table 2.4.2 | The mean and standard deviation AUROC score (with respect to 30 datasets) for cell line U251						
	Image features					
Classifiers	**RGB**	**L*u*v***	**Contrast**	**Correlation**	**Energy**	**Homogeneity**
AdaBoost	0.920 ± 0.046	0.911 ± 0.048	0.971 ± 0.027	0.741 ± 0.099	0.967 ± 0.045	0.975 ± 0.034
Bernoulli Naive Bayes	0.890 ± 0.047	0.903 ± 0.043	0.934 ± 0.055	0.649 ± 0.108	0.859 ± 0.118	0.967 ± 0.059
Dummy Classifier	0.500 ± 0.050	0.492 ± 0.049	0.499 ± 0.059	0.502 ± 0.054	0.503 ± 0.055	0.511 ± 0.055
Extra Trees	0.808 ± 0.152	0.843 ± 0.110	0.653 ± 0.177	0.558 ± 0.098	0.673 ± 0.186	0.838 ± 0.155
Gaussian Naive Bayes	0.908 ± 0.052	0.912 ± 0.051	0.969 ± 0.030	0.698 ± 0.084	0.964 ± 0.033	0.976 ± 0.027
Gradient Boosting	0.924 ± 0.052	0.906 ± 0.046	0.964 ± 0.031	0.830 ± 0.060	0.966 ± 0.040	0.968 ± 0.034
Helstrom Quantum Classifier	0.899 ± 0.057	0.907 ± 0.053	0.948 ± 0.063	0.797 ± 0.093	0.966 ± 0.031	**0.978 ± 0.027**
Linear Discriminant Analysis	0.892 ± 0.062	0.904 ± 0.047	0.916 ± 0.065	0.674 ± 0.087	0.935 ± 0.058	0.975 ± 0.036
Logistic Regression	0.911 ± 0.050	0.917 ± 0.046	0.962 ± 0.030	0.676 ± 0.088	0.962 ± 0.036	0.975 ± 0.034
Multi Layer Perceptron	0.921 ± 0.046	0.918 ± 0.051	0.965 ± 0.034	0.830 ± 0.093	0.962 ± 0.034	0.971 ± 0.040
Nearest Neighbors	0.914 ± 0.051	0.907 ± 0.050	0.964 ± 0.040	0.823 ± 0.062	0.972 ± 0.036	0.978 ± 0.028
Quadratic Discriminant Analysis	0.923 ± 0.053	0.924 ± 0.051	0.972 ± 0.028	0.712 ± 0.085	0.969 ± 0.033	0.976 ± 0.028
Random Forest	0.921 ± 0.050	0.925 ± 0.049	0.975 ± 0.025	0.836 ± 0.076	0.973 ± 0.038	0.972 ± 0.035
SVM - linear	0.916 ± 0.049	0.909 ± 0.047	0.962 ± 0.030	0.651 ± 0.103	0.971 ± 0.030	0.978 ± 0.035
SVM - poly	0.897 ± 0.063	0.901 ± 0.062	0.952 ± 0.061	0.801 ± 0.089	0.969 ± 0.030	0.955 ± 0.051
SVM - rbf	0.849 ± 0.150	0.833 ± 0.156	0.776 ± 0.221	0.634 ± 0.114	0.871 ± 0.189	0.723 ± 0.240

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

S3. Performance of HQC on a new unseen test set (for the best image feature for each cell line)

In this sub-experiment the trained HQC model was tested on a new unseen test set extracted from the remaining 99.8% of the datasets. This experiment was done by randomly selecting 10 datasets (out of the 30 datasets) from the best performing image feature for each of the four cell lines. We show a comparison of the performance on this new unseen test set against the performance on the test set from the 0.2% random sample used in the main experiment.

Table 3.1 | Balance accuracy and AUROC score for HQC on the test set used in the experiment and a new unseen test set for 10 randomly selected homogeneity image feature datasets for cell line MDA-MD-231

Datasets	Balanced accuracy Test set used in the experiment	Balanced accuracy New unseen test set	AUROC Test set used in the experiment	AUROC New unseen test set
P5	0.900	0.943	0.900	0.943
P6	0.977	0.921	0.977	0.921
P7	0.916	0.897	0.946	0.896
P8	0.944	0.937	0.911	0.943
P14	0.971	0.935	1.000	0.933
P15	0.921	0.869	0.947	0.888
P23	0.955	0.968	0.955	0.967
P26	0.977	0.947	0.955	0.944
P27	0.974	0.953	0.946	0.951
P30	0.971	0.951	0.853	0.811
Mean	0.951	0.932	0.939	0.920

Table 3.2 | Balance accuracy and AUROC score for HQC on the test set used in the experiment and a new unseen test set for 10 randomly selected homogeneity image feature datasets for cell line U87-MG

Datasets	Balanced accuracy Test set used in the experiment	Balanced accuracy New unseen test set	AUROC Test set used in the experiment	AUROC New unseen test set
P1	0.931	0.947	0.931	0.947
P2	0.985	0.953	0.985	0.954
P5	0.869	0.908	0.869	0.908
P9	0.943	0.928	0.943	0.940
P10	0.891	0.894	0.891	0.897
P14	0.898	0.868	0.898	0.870
P21	0.964	0.910	0.929	0.901
P22	0.867	0.868	0.839	0.870
P25	0.871	0.893	0.871	0.893
P27	0.980	0.869	0.960	0.871
Mean	0.920	0.904	0.912	0.905

Table 3.3 | Balance accuracy and AUROC score for HQC on the test set used in the experiment and a new unseen test set for 10 randomly selected L*u*v* image feature datasets for cell line MCF7

Datasets	Balanced accuracy Test set used in the experiment	Balanced accuracy New unseen test set	AUROC Test set used in the experiment	AUROC New unseen test set
P6	0.958	0.955	1.000	0.958
P8	0.938	0.949	0.980	0.951
P9	0.982	0.958	0.982	0.955
P13	0.958	0.966	0.979	0.970
P14	0.960	0.978	0.960	0.978
P16	0.984	0.959	0.984	0.951
P19	0.985	0.977	0.985	0.976
P23	0.984	0.967	0.884	0.947
P25	0.875	0.867	0.879	0.886
P26	0.946	0.980	0.971	0.946
Mean	0.957	0.956	0.960	0.952

Table 3.4 | Balance accuracy and AUROC score for HQC on the test set used in the experiment and a new unseen test set for 10 randomly selected homogeneity image feature datasets for cell line U251

Datasets	Balanced accuracy Test set used in the experiment	Balanced accuracy New unseen test set	AUROC Test set used in the experiment	AUROC New unseen test set
P2	1.000	0.985	1.000	0.977
P7	0.974	0.962	0.974	0.962
P15	0.962	0.956	0.962	0.898
P18	0.927	0.971	0.927	0.971
P20	1.000	0.960	1.000	0.959
P21	0.950	0.964	0.950	0.964
P22	0.974	0.941	0.974	0.948
P27	0.982	0.965	0.982	0.973
P29	0.980	0.926	0.938	0.932
P30	0.982	0.976	0.982	0.968
Mean	0.973	0.961	0.969	0.955

S4. Experimental results - extended version

This section contains tables showing the experimental results for the balanced accuracy and AUROC scores for the six image features *RGB*, *L*u*v**, *contrast*, *correlation*, *energy* and *homogeneity*, for each of the four cell lines MDA-MD-231, U87-MG, MCF7 and U251 respectively.

Table 4.1 | Balanced accuracy score for 30 RGB image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.855	0.647	0.586	0.820	0.917	0.808	0.851	0.938	0.907	0.789	0.838	0.921	0.858	0.925	0.734	0.938	0.896	0.858	0.875	0.866	0.978	1.000	0.890	0.917	0.863	0.881	0.796	0.885	0.980	0.807
Bernoulli Naive Bayes	0.738	0.756	0.755	0.897	0.889	0.720	0.850	0.906	0.857	0.741	0.814	0.891	0.916	0.866	0.778	0.878	0.946	0.865	0.761	0.875	0.828	0.843	0.904	0.863	0.807	0.894	0.789	0.856	0.878	0.871
Dummy Classifier	0.612	0.500	0.500	0.500	0.500	0.506	0.500	0.558	0.418	0.500	0.500	0.500	0.568	0.500	0.461	0.500	0.544	0.484	0.500	0.599	0.418	0.500	0.561	0.500	0.599	0.428	0.473	0.500	0.468	0.510
Extra Trees	0.855	0.577	0.500	0.835	0.917	0.742	0.938	0.938	0.893	0.750	0.813	0.935	0.864	0.866	0.764	0.625	0.941	0.923	0.795	0.900	0.857	0.825	0.890	0.890	0.864	0.500	0.820	0.885	0.897	0.866
Gaussian Naive Bayes	0.795	0.816	0.804	0.897	0.917	0.742	0.850	0.938	0.821	0.789	0.787	0.891	0.955	0.871	0.742	0.938	0.946	0.904	0.795	0.900	0.750	0.864	0.890	0.917	0.807	0.913	0.789	0.856	0.918	0.846
Gradient Boosting	0.917	0.763	0.685	0.851	0.890	0.753	0.818	0.969	0.885	0.882	0.705	0.871	0.935	0.896	0.792	0.938	0.971	0.897	0.858	0.866	0.943	1.000	0.890	0.947	0.863	0.931	0.851	0.899	0.980	0.837
Helstrom Quantum Classifier	0.918	0.816	0.820	0.866	0.889	0.841	0.914	0.938	0.964	0.851	0.893	0.885	0.897	0.925	0.734	0.980	0.921	0.923	0.875	0.950	0.871	0.979	0.935	0.889	0.835	0.963	0.812	0.943	0.980	0.841
Linear Discriminant Analysis	0.837	0.857	0.734	0.842	0.917	0.764	0.866	0.938	0.835	0.781	0.789	0.870	0.916	0.900	0.778	0.897	0.971	0.885	0.688	0.850	0.835	0.938	0.825	0.833	0.756	0.881	0.812	0.899	0.940	0.866
Logistic Regression	0.857	0.920	0.817	0.890	0.917	0.798	0.882	0.938	0.871	0.757	0.839	0.899	0.935	0.896	0.778	0.938	0.946	0.885	0.795	0.900	0.835	0.979	0.890	0.917	0.782	0.981	0.820	0.907	0.980	0.921
Multi Layer Perceptron	0.857	0.861	0.817	0.882	0.917	0.798	0.859	0.945	0.964	0.859	0.760	0.849	0.916	0.921	0.770	0.940	0.921	0.942	0.875	0.866	0.893	0.979	0.935	0.920	0.889	0.931	0.875	0.871	0.980	0.896
Nearest Centroid	0.797	0.812	0.804	0.874	0.889	0.741	0.897	0.906	0.857	0.789	0.788	0.848	0.916	0.791	0.742	0.897	0.946	0.827	0.716	0.850	0.764	0.825	0.890	0.861	0.808	0.913	0.812	0.856	0.918	0.846
Nearest Neighbors	0.857	0.668	0.702	0.890	0.917	0.855	0.859	0.976	0.929	0.844	0.867	0.849	0.909	0.921	0.814	0.938	0.946	0.942	0.875	0.946	0.943	0.958	0.890	0.918	0.863	0.931	0.851	0.943	0.980	0.916
Passive Aggressive Classifier	0.793	0.784	0.868	0.914	0.863	0.508	0.890	0.890	0.762	0.741	0.732	0.834	0.878	0.744	0.778	0.918	0.946	0.885	0.750	0.875	0.770	0.979	0.916	0.833	0.890	0.963	0.827	0.814	1.000	0.593
Perceptron	0.857	0.647	0.500	0.882	0.917	0.655	0.750	0.897	0.821	0.621	0.785	0.685	0.684	0.816	0.562	0.920	0.825	0.734	0.778	0.694	0.814	0.941	0.753	0.861	0.756	0.931	0.851	0.877	0.980	0.891
Quadratic Discriminant Analysis	0.877	0.760	0.884	0.890	0.889	0.752	0.921	0.914	0.835	0.812	0.893	0.863	0.916	0.896	0.778	0.960	0.971	0.904	0.750	0.841	0.814	0.979	0.935	0.838	0.808	0.913	0.882	0.899	0.980	0.807
Random Forest	0.875	0.784	0.618	0.914	0.917	0.730	0.969	0.938	0.871	0.772	0.839	0.871	0.935	0.925	0.756	0.918	0.971	0.923	0.875	0.866	0.893	0.941	0.890	0.917	0.863	0.931	0.827	0.863	0.980	0.841
SVM - linear	0.857	0.798	0.884	0.914	0.917	0.798	0.859	0.938	0.835	0.757	0.788	0.856	0.935	0.925	0.778	0.938	0.971	0.904	0.795	0.871	0.835	0.979	0.890	0.917	0.863	0.963	0.820	0.907	0.980	0.921
SVM - poly	0.835	0.784	0.868	0.859	0.917	0.876	0.914	0.938	0.964	0.820	0.814	0.871	0.832	0.950	0.778	0.837	0.846	0.942	0.858	0.941	0.835	0.962	0.890	0.944	0.947	0.876	0.890	0.835	0.980	0.896
SVM - rbf	0.857	0.857	0.884	0.914	0.889	0.753	0.859	0.938	0.857	0.757	0.788	0.842	0.935	0.925	0.778	0.938	0.971	0.885	0.795	0.871	0.835	0.979	0.890	0.889	0.863	0.963	0.812	0.907	0.980	0.871

Table 4.2 | Balanced accuracy score for 30 L*u*v* image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.734	0.789	0.875	0.943	0.890	0.804	0.895	0.796	0.866	0.898	0.946	0.967	0.795	0.906	0.757	0.769	0.898	0.941	0.849	0.921	0.864	0.921	0.978	0.835	0.952	0.871	0.947	0.913	0.918	0.895
Bernoulli Naive Bayes	0.904	0.866	0.844	0.907	0.906	0.804	0.784	0.750	0.701	0.712	0.918	0.944	0.692	0.859	0.741	0.824	0.932	0.878	0.842	0.941	0.727	0.921	0.899	0.938	0.881	0.871	0.946	0.863	0.918	0.946
Dummy Classifier	0.399	0.500	0.606	0.500	0.500	0.484	0.430	0.456	0.583	0.500	0.458	0.500	0.500	0.582	0.500	0.543	0.517	0.500	0.505	0.500	0.509	0.487	0.453	0.653	0.606	0.500	0.500	0.500	0.500	0.621
Extra Trees	0.844	0.632	0.500	0.943	0.906	0.784	0.864	0.796	0.820	0.500	0.918	0.967	0.738	0.952	0.850	0.500	0.932	0.979	0.778	0.946	0.778	0.921	0.957	0.921	0.929	0.750	1.000	0.863	0.958	0.947
Gaussian Naive Bayes	0.897	0.796	0.775	0.929	0.938	0.801	0.865	0.796	0.820	0.732	0.918	0.967	0.707	0.882	0.821	0.681	0.932	0.958	0.885	0.941	0.781	0.895	0.957	0.938	0.976	0.821	1.000	0.899	0.958	0.947
Gradient Boosting	0.825	0.804	0.853	0.943	0.914	0.766	0.895	0.796	0.890	0.815	0.867	0.911	0.795	0.859	0.762	0.698	0.865	1.000	0.828	0.891	0.836	0.921	0.964	0.914	0.952	0.921	0.921	0.921	0.938	0.947
Helstrom Quantum Classifier	0.844	0.859	0.838	0.943	0.938	0.822	0.892	0.796	0.905	0.733	0.920	0.933	0.708	0.882	0.707	0.879	0.898	0.979	0.885	0.916	0.892	0.921	0.935	0.914	0.905	0.929	0.972	0.899	0.938	0.918
Linear Discriminant Analysis	0.890	0.890	0.791	0.907	0.906	0.819	0.865	0.750	0.804	0.752	0.917	0.967	0.740	0.906	0.821	0.626	0.909	0.938	0.849	0.921	0.753	0.895	0.935	0.906	0.929	0.821	0.946	0.891	0.938	0.974
Logistic Regression	0.844	0.859	0.938	0.943	0.938	0.804	0.838	0.796	0.835	0.733	0.944	0.967	0.708	0.906	0.821	0.626	0.898	0.958	0.842	0.946	0.781	0.921	0.978	0.938	0.921	0.893	0.972	0.899	0.958	0.974
Multi Layer Perceptron	0.844	0.859	0.938	0.885	0.938	0.804	0.838	0.766	0.929	0.837	0.946	0.967	0.763	0.827	0.757	0.824	0.921	0.979	0.820	0.812	0.838	0.921	0.957	0.906	0.952	0.964	0.972	0.877	0.938	0.974
Nearest Centroid	0.916	0.921	0.844	0.907	0.938	0.760	0.865	0.750	0.851	0.653	0.864	0.967	0.723	0.851	0.821	0.790	0.876	0.917	0.863	0.916	0.754	0.895	0.957	0.938	0.929	0.821	0.972	0.913	0.938	0.918
Nearest Neighbors	0.890	0.882	0.822	0.899	0.938	0.784	0.864	0.800	0.859	0.813	0.893	0.967	0.802	0.859	0.766	0.714	0.898	0.941	0.863	0.837	0.835	0.920	0.921	0.921	0.929	0.929	0.974	0.835	0.918	0.974
Passive Aggressive Classifier	0.942	0.820	0.875	0.943	0.945	0.745	0.753	0.712	0.701	0.580	0.944	0.830	0.638	0.668	0.678	0.643	0.732	0.920	0.755	0.691	0.751	0.868	0.935	0.890	0.976	0.857	0.918	0.792	0.792	0.974
Perceptron	0.935	0.796	0.838	0.929	0.859	0.825	0.868	0.753	0.763	0.673	0.892	0.865	0.804	0.906	0.746	0.483	0.886	0.774	0.863	0.866	0.567	0.895	0.929	0.938	0.921	0.821	0.944	0.792	0.918	0.918
Quadratic Discriminant Analysis	0.935	0.757	0.922	0.943	0.906	0.804	0.839	0.825	0.859	0.732	0.918	0.967	0.802	0.906	0.762	0.698	0.932	0.920	0.863	0.891	0.781	0.895	0.978	0.914	0.952	0.857	0.947	0.899	0.938	0.947
Random Forest	0.871	0.882	0.838	0.907	0.938	0.843	0.895	0.800	0.874	0.775	0.920	0.967	0.763	0.882	0.787	0.698	0.932	0.979	0.863	0.921	0.727	0.921	0.978	0.945	0.976	0.871	0.947	0.899	0.938	0.947
SVM - linear	0.890	0.890	0.838	0.907	0.906	0.804	0.839	0.771	0.772	0.753	0.944	0.944	0.723	0.906	0.821	0.698	0.909	0.958	0.842	0.946	0.753	0.921	0.913	0.938	0.952	0.857	0.972	0.899	0.938	0.974
SVM - poly	0.890	0.827	0.838	0.943	0.945	0.843	0.921	0.796	0.897	0.775	0.944	0.933	0.716	0.859	0.821	0.790	0.898	0.979	0.863	0.921	0.838	0.921	0.957	0.969	0.976	0.893	1.000	0.885	0.938	0.974
SVM - rbf	0.890	0.921	0.822	0.907	0.906	0.825	0.867	0.771	0.772	0.733	0.944	0.967	0.762	0.906	0.771	0.626	0.932	0.958	0.842	0.946	0.781	0.895	0.935	0.938	0.952	0.857	0.972	0.899	0.938	0.974

Table 4.3 | Balanced accuracy score for 30 contrast image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.835	0.823	0.879	0.918	0.866	0.744	0.795	0.909	0.945	0.978	0.881	0.975	0.890	0.890	0.804	0.784	0.933	0.921	0.909	0.974	0.972	0.925	0.920	0.891	0.921	0.799	0.971	0.905	0.969	1.000
Bernoulli Naive Bayes	0.817	0.657	0.500	0.917	0.765	0.846	0.778	0.888	0.812	0.943	0.882	0.875	0.890	0.839	0.739	0.869	0.933	0.929	0.909	0.918	0.890	0.850	0.784	0.771	0.944	0.824	0.925	0.921	0.699	0.886
Dummy Classifier	0.500	0.500	0.500	0.488	0.567	0.556	0.500	0.500	0.500	0.500	0.500	0.500	0.591	0.500	0.596	0.500	0.608	0.500	0.500	0.535	0.500	0.500	0.484	0.544	0.417	0.356	0.500	0.307	0.440	0.685
Extra Trees	0.500	0.500	0.500	0.750	0.625	0.588	0.914	0.911	0.531	0.500	0.719	0.946	0.556	0.864	0.801	0.500	0.500	0.820	0.727	0.722	0.579	0.950	0.731	0.746	0.933	0.588	0.921	0.571	0.844	0.932
Gaussian Naive Bayes	0.817	0.886	0.862	0.918	0.789	0.782	0.881	0.888	0.875	0.821	0.914	0.975	0.890	0.839	0.878	0.800	0.933	0.945	0.864	0.946	0.841	0.950	0.840	0.796	0.977	0.824	1.000	0.897	1.000	0.955
Gradient Boosting	0.855	0.841	0.879	0.918	0.914	0.719	0.929	0.842	0.921	0.943	0.905	0.916	0.835	0.918	0.825	0.784	0.967	0.890	0.909	1.000	1.000	0.921	0.864	0.866	0.955	0.857	0.941	0.874	0.969	1.000
Helstrom Quantum Classifier	0.911	0.834	0.812	0.917	0.882	0.699	0.857	0.865	0.906	1.000	0.952	0.950	0.836	0.813	0.804	0.800	0.933	0.952	0.909	0.946	0.972	0.925	0.899	0.921	0.977	0.857	0.975	0.969	1.000	0.977
Linear Discriminant Analysis	0.800	0.795	0.643	0.917	0.695	0.807	0.802	0.855	0.844	0.857	0.882	0.900	0.863	0.865	0.801	0.800	0.867	0.842	0.773	0.972	0.762	0.875	0.724	0.771	0.967	0.794	0.950	0.859	0.905	0.909
Logistic Regression	0.873	0.886	0.879	0.890	0.789	0.715	0.818	0.888	0.906	0.835	0.952	0.975	0.890	0.839	0.822	0.800	0.900	0.914	0.818	0.972	0.893	0.925	0.843	0.821	0.944	0.824	0.975	0.929	1.000	0.977
Multi Layer Perceptron	0.909	0.744	0.845	0.917	0.859	0.803	0.921	0.955	0.938	1.000	0.929	0.975	0.807	0.813	0.804	0.784	0.933	0.921	0.909	0.944	0.972	0.900	0.899	0.921	0.977	0.828	0.975	0.881	1.000	0.977
Nearest Centroid	0.782	0.675	0.795	0.918	0.772	0.841	0.802	0.855	0.875	0.790	0.929	0.871	0.836	0.867	0.822	0.784	0.900	0.835	0.818	0.946	0.839	0.900	0.766	0.766	0.967	0.744	0.975	0.859	0.905	0.932
Nearest Neighbors	0.909	0.664	0.895	0.944	0.835	0.782	0.952	0.944	0.938	0.964	0.929	0.975	0.835	0.813	0.825	0.784	0.933	0.921	0.909	0.944	0.974	0.896	0.878	0.921	0.932	0.882	1.000	0.952	1.000	0.955
Passive Aggressive Classifier	0.617	0.748	0.862	0.890	0.664	0.794	0.850	0.865	0.668	0.585	0.881	0.871	0.890	0.787	0.801	0.784	0.900	0.859	0.935	0.833	0.500	0.950	0.808	0.887	0.977	0.941	0.975	0.802	0.969	0.944
Perceptron	0.631	0.834	0.829	0.944	0.772	0.719	0.833	0.585	0.804	0.689	0.881	0.975	0.890	0.734	0.801	0.900	0.877	0.945	0.864	0.863	0.705	0.946	0.742	0.599	0.921	0.824	0.975	0.921	0.952	0.977
Quadratic Discriminant Analysis	0.817	0.806	0.719	0.918	0.757	0.837	0.826	0.877	0.851	0.964	0.882	0.946	0.864	0.813	0.798	0.800	0.933	0.945	0.909	0.972	0.867	0.950	0.857	0.746	0.977	0.794	1.000	0.929	0.976	0.955
Random Forest	0.855	0.886	0.895	0.918	0.921	0.769	0.881	0.888	0.945	1.000	0.952	0.975	0.889	0.865	0.885	0.784	0.967	0.945	0.909	0.974	0.972	0.950	0.920	0.896	0.977	0.857	1.000	0.905	1.000	0.977
SVM - linear	0.835	0.823	0.879	0.890	0.765	0.749	0.787	0.888	0.875	0.943	0.929	0.975	0.890	0.865	0.784	0.800	0.900	0.969	0.864	0.946	0.890	0.900	0.825	0.796	0.977	0.794	1.000	0.929	0.969	0.977
SVM - poly	0.873	0.886	0.845	0.946	0.820	0.837	0.818	0.865	0.938	0.978	0.905	0.853	0.751	0.785	0.784	0.869	0.933	0.921	0.909	0.944	0.974	0.950	0.920	0.891	0.977	0.916	1.000	0.905	1.000	0.977
SVM - rbf	0.817	0.823	0.879	0.890	0.796	0.749	0.826	0.888	0.906	0.943	0.952	0.975	0.890	0.918	0.784	0.800	0.900	0.945	0.864	0.972	0.918	0.900	0.864	0.821	0.977	0.794	1.000	0.929	1.000	0.977

Table 4.4 | Balanced accuracy score for 30 correlation image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.757	0.583	0.519	0.728	0.801	0.701	0.785	0.558	0.853	0.757	0.565	0.832	0.765	0.814	0.519	0.648	0.897	0.784	0.833	0.900	0.877	0.770	0.742	0.598	0.745	0.863	0.850	0.665	0.710	0.730
Bernoulli Naive Bayes	0.683	0.583	0.500	0.623	0.500	0.467	0.781	0.455	0.502	0.708	0.719	0.586	0.734	0.756	0.421	0.500	0.740	0.784	0.595	0.803	0.425	0.503	0.713	0.674	0.721	0.776	0.818	0.458	0.656	0.730
Dummy Classifier	0.602	0.596	0.570	0.538	0.516	0.500	0.596	0.426	0.506	0.500	0.500	0.523	0.600	0.500	0.500	0.500	0.500	0.500	0.484	0.603	0.510	0.500	0.500	0.500	0.500	0.500	0.472	0.500	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.684	0.500	0.546	0.781	0.557	0.500	0.500	0.694	0.591	0.531	0.693	0.561	0.500	0.656	0.719	0.615	0.925	0.667	0.526	0.786	0.600	0.816	0.500	0.810	0.500	0.500	0.730
Gaussian Naive Bayes	0.813	0.483	0.583	0.678	0.652	0.560	0.754	0.565	0.649	0.814	0.694	0.871	0.781	0.778	0.481	0.648	0.780	0.741	0.668	0.853	0.712	0.770	0.800	0.709	0.816	0.744	0.850	0.710	0.632	0.730
Gradient Boosting	0.844	0.583	0.487	0.946	0.801	0.780	0.867	0.945	0.909	0.892	0.685	0.916	0.757	0.856	0.659	0.812	0.945	0.913	0.822	0.975	0.918	0.756	0.742	0.832	0.861	0.881	0.874	0.958	0.890	0.946
Helstrom Quantum Classifier	0.681	0.683	0.739	0.728	0.798	0.653	0.784	0.826	0.764	0.674	0.728	0.813	0.859	0.727	0.540	0.833	0.914	0.804	0.795	0.946	0.773	0.727	0.776	0.788	0.816	0.844	0.850	0.795	0.859	0.730
Linear Discriminant Analysis	0.813	0.483	0.500	0.652	0.566	0.615	0.754	0.558	0.500	0.681	0.669	0.650	0.882	0.677	0.481	0.576	0.741	0.784	0.553	0.882	0.505	0.640	0.756	0.686	0.816	0.744	0.850	0.500	0.577	0.703
Logistic Regression	0.831	0.483	0.500	0.652	0.566	0.583	0.754	0.558	0.500	0.681	0.669	0.650	0.875	0.655	0.481	0.450	0.741	0.784	0.553	0.912	0.505	0.640	0.778	0.686	0.837	0.763	0.850	0.500	0.570	0.703
Multi Layer Perceptron	0.713	0.615	0.769	0.756	0.861	0.835	0.811	0.826	0.762	0.787	0.728	0.890	0.827	0.784	0.697	0.862	0.969	0.891	0.840	0.971	0.898	0.806	0.877	0.755	0.899	1.000	0.881	0.938	0.906	0.838
Nearest Centroid	0.739	0.672	0.524	0.675	0.614	0.598	0.782	0.606	0.633	0.756	0.694	0.710	0.859	0.748	0.421	0.690	0.756	0.806	0.585	0.882	0.550	0.567	0.778	0.753	0.753	0.770	0.850	0.425	0.670	0.703
Nearest Neighbors	0.731	0.620	0.634	0.810	0.822	0.811	0.868	0.787	0.835	0.732	0.724	0.844	0.789	0.792	0.739	0.862	0.914	0.913	0.875	0.891	0.857	0.877	0.834	0.788	0.816	0.763	0.850	0.816	0.851	0.784
Passive Aggressive Classifier	0.607	0.478	0.435	0.456	0.524	0.600	0.699	0.604	0.631	0.678	0.449	0.572	0.890	0.734	0.551	0.657	0.625	0.828	0.620	0.837	0.473	0.450	0.691	0.665	0.415	0.807	0.826	0.418	0.531	0.458
Perceptron	0.726	0.559	0.500	0.677	0.500	0.594	0.640	0.582	0.615	0.417	0.500	0.598	0.710	0.627	0.620	0.724	0.747	0.733	0.638	0.757	0.548	0.446	0.756	0.683	0.591	0.789	0.818	0.500	0.670	0.678
Quadratic Discriminant Analysis	0.681	0.502	0.583	0.816	0.673	0.512	0.782	0.692	0.742	0.811	0.690	0.787	0.882	0.713	0.540	0.736	0.882	0.848	0.787	0.971	0.568	0.669	0.713	0.642	0.795	0.776	0.850	0.798	0.789	0.703
Random Forest	0.850	0.520	0.503	0.947	0.843	0.685	0.839	0.763	0.871	0.865	0.753	0.871	0.820	0.978	0.679	0.752	0.976	0.913	0.899	1.000	0.857	0.748	0.742	0.798	0.801	0.881	0.850	0.979	0.938	0.893
SVM - linear	0.731	0.483	0.500	0.652	0.500	0.591	0.754	0.558	0.500	0.500	0.690	0.650	0.882	0.748	0.386	0.483	0.772	0.828	0.574	0.853	0.547	0.711	0.800	0.732	0.837	0.813	0.850	0.500	0.500	0.730
SVM - poly	0.676	0.589	0.852	0.810	0.822	0.749	0.756	0.818	0.817	0.785	0.594	0.871	0.851	0.877	0.718	0.812	0.976	0.834	0.896	0.891	0.795	0.776	0.792	0.855	0.899	0.794	0.850	0.917	0.882	0.782
SVM - rbf	0.750	0.483	0.500	0.652	0.566	0.591	0.754	0.558	0.500	0.500	0.690	0.689	0.875	0.748	0.481	0.483	0.772	0.863	0.668	0.882	0.545	0.668	0.800	0.653	0.857	0.763	0.826	0.500	0.500	0.730

Table 4.5 | Balanced accuracy score for 30 energy image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.944	0.923	0.857	0.929	1.000	0.836	0.943	1.000	0.785	0.866	0.978	0.971	0.969	0.944	0.864	0.938	0.981	0.946	1.000	0.972	0.976	0.921	0.938	0.943	0.975	0.955	0.947	0.855	0.964	0.958
Bernoulli Naive Bayes	0.944	0.846	0.967	0.821	0.833	0.861	0.848	0.781	0.725	0.850	0.857	0.950	0.938	0.933	0.841	0.528	0.916	0.833	0.804	0.865	0.881	0.875	0.708	0.821	0.900	0.818	0.921	0.886	0.964	0.917
Dummy Classifier	0.500	0.620	0.500	0.500	0.656	0.513	0.339	0.519	0.500	0.500	0.354	0.451	0.500	0.517	0.512	0.500	0.516	0.500	0.500	0.500	0.442	0.500	0.343	0.483	0.500	0.547	0.648	0.500	0.500	0.460
Extra Trees	0.778	0.692	0.500	0.551	0.553	0.750	0.891	0.810	0.500	0.735	0.929	1.000	0.929	0.911	0.865	0.500	0.909	0.871	0.500	0.864	0.500	0.882	0.708	0.821	0.975	0.500	0.944	0.841	0.893	0.917
Gaussian Naive Bayes	0.944	0.885	0.840	0.893	0.944	0.889	0.899	1.000	0.839	0.816	0.929	1.000	0.969	0.944	0.867	0.688	0.981	0.946	1.000	0.892	0.976	0.941	0.917	0.964	1.000	0.890	0.974	0.932	1.000	0.938
Gradient Boosting	0.982	0.923	0.929	0.929	1.000	0.863	0.921	1.000	0.839	0.837	0.978	1.000	0.969	0.944	0.864	0.920	0.981	0.929	1.000	0.918	1.000	0.921	0.958	0.943	0.975	1.000	0.947	0.888	0.957	0.920
Helstrom Quantum Classifier	0.927	0.846	0.857	0.929	0.918	1.000	0.957	0.969	0.813	0.925	0.964	0.971	0.969	0.944	0.814	0.983	0.981	0.927	0.935	0.946	0.938	0.946	0.958	0.964	1.000	0.923	0.974	0.955	0.964	0.938
Linear Discriminant Analysis	0.778	0.846	0.786	0.893	0.944	0.861	0.935	0.812	0.728	0.846	0.893	0.950	0.976	0.911	0.867	0.500	0.916	0.778	0.935	0.892	0.945	0.846	0.917	0.857	0.900	0.773	0.867	0.864	0.893	0.896
Logistic Regression	0.944	0.885	0.769	0.893	1.000	0.889	0.899	1.000	0.867	0.841	0.929	1.000	0.969	0.944	0.893	0.858	0.981	0.929	1.000	0.893	0.945	0.971	0.958	0.964	0.975	1.000	0.974	0.888	0.978	0.938
Multi Layer Perceptron	0.964	0.885	0.840	0.893	1.000	0.946	0.921	1.000	0.867	0.871	0.907	1.000	0.969	0.944	0.867	1.000	0.981	0.927	0.978	0.972	0.969	0.946	0.958	0.964	0.975	1.000	0.974	0.798	0.978	0.958
Nearest Centroid	0.798	0.846	0.929	0.857	0.861	0.702	0.899	0.812	0.756	0.825	0.929	0.975	0.969	0.821	0.814	0.862	0.942	0.889	0.870	0.838	0.905	0.846	0.917	0.857	0.975	0.806	0.921	0.886	0.893	0.801
Nearest Neighbors	0.982	0.825	0.857	0.943	0.946	0.944	0.921	1.000	0.865	0.950	0.929	1.000	0.969	0.921	0.788	0.983	0.981	0.909	0.957	0.946	0.969	0.971	0.958	0.964	1.000	0.962	0.946	0.955	0.964	0.958
Passive Aggressive Classifier	0.873	0.846	0.840	0.964	0.972	0.917	0.899	0.969	0.838	0.816	0.957	0.941	0.969	0.944	0.839	0.692	0.890	0.893	0.964	0.893	0.945	0.971	0.917	0.921	0.975	0.909	0.974	0.855	0.943	0.885
Perceptron	0.909	0.846	0.933	0.929	0.944	0.833	0.935	0.938	0.868	0.841	0.929	0.941	0.976	0.944	0.865	0.726	0.935	0.893	0.957	0.918	0.945	0.941	0.875	0.964	0.975	0.923	0.974	0.855	0.964	0.938
Quadratic Discriminant Analysis	0.944	0.885	0.840	0.893	0.944	0.889	0.899	1.000	0.839	0.841	0.907	0.971	0.969	0.944	0.841	0.688	0.981	0.946	1.000	0.892	0.976	0.941	0.958	0.964	1.000	0.935	0.974	0.932	1.000	0.958
Random Forest	0.944	0.923	0.857	0.907	1.000	0.917	0.921	1.000	0.867	0.866	0.978	1.000	0.969	0.944	0.918	0.938	0.981	0.946	1.000	0.972	0.945	0.971	0.938	0.943	0.975	0.909	0.974	0.855	1.000	0.958
SVM - linear	0.944	0.885	0.769	0.893	1.000	0.889	0.899	1.000	0.839	0.866	0.907	1.000	0.969	0.944	0.920	0.858	0.981	0.946	0.964	0.920	0.945	0.921	0.958	0.964	0.975	0.955	0.974	0.888	0.964	0.938
SVM - poly	0.927	0.902	0.786	0.964	0.974	0.918	0.899	0.969	0.841	0.871	0.871	0.971	0.969	0.888	0.867	0.983	0.897	0.909	1.000	0.920	0.969	0.946	0.958	0.964	1.000	0.935	0.947	0.855	0.943	0.938
SVM - rbf	0.944	0.885	0.769	0.893	1.000	0.889	0.921	1.000	0.839	0.866	0.907	1.000	0.969	0.944	0.920	0.858	0.981	0.946	0.957	0.920	0.976	0.921	0.958	0.964	0.975	0.955	0.974	0.888	0.964	0.938

Table 4.6 | Balanced accuracy score for 30 homogeneity image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	0.958	0.950	1.000	0.911	0.977	0.925	0.911	0.832	0.828	0.918	0.955	0.916	0.941	0.864	0.879	0.978	0.971	1.000	0.969	0.893	0.947	0.955	0.971	1.000	0.955	0.946	0.957	0.945	1.000
Bernoulli Naive Bayes	0.979	0.958	0.736	1.000	0.921	0.977	0.950	0.921	0.842	0.896	0.890	1.000	0.921	0.971	0.947	0.862	0.921	0.971	0.942	0.969	1.000	0.947	0.955	1.000	0.944	0.865	0.946	0.978	0.976	1.000
Dummy Classifier	0.345	0.603	0.510	0.418	0.500	0.500	0.490	0.500	0.539	0.560	0.380	0.427	0.500	0.500	0.512	0.526	0.500	0.578	0.353	0.500	0.425	0.500	0.500	0.500	0.495	0.518	0.500	0.500	0.500	0.384
Extra Trees	0.885	0.500	0.500	0.913	0.800	0.933	0.921	0.888	0.865	0.882	0.921	0.977	0.850	1.000	0.920	0.500	0.929	0.941	0.818	1.000	0.679	0.946	1.000	0.941	0.967	0.733	0.835	0.870	0.812	0.794
Gaussian Naive Bayes	1.000	1.000	0.967	1.000	0.821	0.977	0.946	0.921	0.865	0.912	0.890	0.977	0.891	0.971	0.947	0.895	1.000	0.971	1.000	1.000	0.964	0.946	0.955	1.000	0.944	0.977	0.974	0.957	0.945	1.000
Gradient Boosting	0.958	0.938	0.950	1.000	0.821	0.977	0.866	0.888	0.865	0.912	0.892	0.977	0.891	0.912	0.863	0.824	0.978	0.971	1.000	0.969	0.929	0.947	0.955	0.971	1.000	0.977	0.974	0.921	0.914	0.941
Helstrom Quantum Classifier	0.962	0.902	0.967	1.000	0.900	0.977	0.916	0.944	0.888	0.912	0.920	0.977	0.925	0.971	0.921	0.895	0.978	1.000	1.000	1.000	1.000	0.974	0.955	1.000	1.000	0.977	0.974	0.957	1.000	0.971
Linear Discriminant Analysis	1.000	0.923	0.983	1.000	0.821	1.000	0.946	0.909	0.865	0.912	0.890	1.000	0.862	0.971	0.947	0.895	1.000	0.971	1.000	1.000	1.000	0.947	0.955	1.000	1.000	0.955	0.974	0.978	0.945	1.000
Logistic Regression	1.000	0.920	1.000	1.000	0.833	0.977	0.946	0.898	0.865	0.912	0.890	0.977	0.921	0.971	0.920	0.879	1.000	0.971	1.000	1.000	0.964	0.947	0.932	1.000	0.967	0.977	0.974	0.957	0.945	1.000
Multi Layer Perceptron	1.000	0.917	0.983	1.000	0.877	0.977	0.891	0.955	0.888	0.887	0.500	1.000	0.921	0.912	0.947	0.912	1.000	0.971	1.000	1.000	0.964	0.947	0.898	1.000	0.967	0.977	1.000	0.978	0.945	0.971
Nearest Centroid	0.917	0.941	0.950	1.000	0.877	0.944	0.866	0.876	0.865	0.862	0.890	0.977	0.975	0.971	0.974	0.883	0.978	0.941	1.000	1.000	0.964	0.920	1.000	0.916	0.944	0.955	0.946	0.978	0.976	0.946
Nearest Neighbors	0.923	0.979	0.950	1.000	0.844	0.977	0.921	0.955	0.888	0.941	0.920	1.000	0.925	0.912	0.893	0.912	1.000	0.946	1.000	1.000	1.000	0.974	0.921	1.000	0.944	0.977	0.974	0.978	0.969	0.971
Passive Aggressive Classifier	0.798	0.979	0.950	0.964	0.833	0.977	0.946	0.909	0.865	0.891	0.895	0.955	0.950	1.000	0.918	0.895	1.000	0.941	0.942	1.000	0.821	0.920	0.932	1.000	0.944	0.977	0.974	0.957	0.976	0.946
Perceptron	0.899	0.917	0.983	1.000	0.921	0.921	0.875	0.932	0.729	0.799	0.946	0.955	0.866	0.891	0.836	0.879	0.978	0.828	0.955	0.976	0.929	0.946	0.955	0.971	0.886	0.933	0.946	0.891	0.976	0.975
Quadratic Discriminant Analysis	1.000	0.902	0.950	1.000	0.900	0.977	0.921	0.944	0.865	0.941	0.890	0.977	0.921	1.000	0.947	0.895	1.000	0.971	1.000	1.000	1.000	0.947	0.932	1.000	0.967	0.955	0.974	0.957	0.976	1.000
Random Forest	1.000	0.938	0.950	1.000	0.877	0.977	0.921	0.911	0.865	0.912	0.918	0.955	0.921	0.941	0.920	0.912	0.978	0.971	1.000	1.000	0.929	0.947	0.955	1.000	0.967	0.977	0.974	0.957	0.945	1.000
SVM - linear	1.000	0.881	0.967	1.000	0.833	0.977	0.946	0.921	0.865	0.912	0.864	0.955	0.921	1.000	0.974	0.879	1.000	0.971	0.955	1.000	0.929	0.947	0.932	1.000	0.967	0.977	0.974	0.957	0.976	1.000
SVM - poly	0.923	0.979	1.000	1.000	0.877	0.977	0.891	0.921	0.888	0.912	0.890	1.000	0.925	0.941	0.893	0.879	1.000	0.971	1.000	1.000	0.964	0.947	0.932	1.000	0.967	0.955	0.974	0.957	1.000	0.941
SVM - rbf	1.000	0.923	0.983	1.000	0.833	0.977	0.946	0.898	0.865	0.912	0.864	0.977	0.921	0.971	0.920	0.879	1.000	0.941	1.000	1.000	0.964	0.920	0.932	1.000	0.967	0.977	0.974	0.957	0.945	1.000

Table 4.7 | AUROC score for 30 RGB image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.855	0.804	0.618	0.882	0.917	0.764	0.882	0.906	0.885	0.789	0.865	0.885	0.858	0.925	0.756	0.938	0.946	0.923	0.875	0.971	0.943	0.979	0.890	0.892	0.863	0.931	0.796	0.885	0.980	0.803
Bernoulli Naive Bayes	0.738	0.756	0.755	0.897	0.889	0.720	0.850	0.906	0.857	0.741	0.814	0.891	0.916	0.866	0.778	0.878	0.946	0.865	0.761	0.875	0.828	0.843	0.904	0.863	0.807	0.894	0.789	0.856	0.878	0.871
Dummy Classifier	0.500	0.500	0.470	0.500	0.500	0.500	0.598	0.500	0.500	0.500	0.500	0.500	0.463	0.526	0.500	0.485	0.510	0.463	0.500	0.500	0.500	0.500	0.477	0.500	0.500	0.500	0.558	0.500	0.548	0.544
Extra Trees	0.855	0.500	0.500	0.921	0.917	0.765	0.882	0.938	0.893	0.812	0.865	0.935	0.818	0.866	0.764	0.542	0.941	0.878	0.688	0.900	0.821	0.846	0.890	0.813	0.784	0.500	0.820	0.907	0.938	0.896
Gaussian Naive Bayes	0.795	0.816	0.804	0.897	0.917	0.742	0.850	0.938	0.821	0.789	0.787	0.891	0.955	0.871	0.742	0.938	0.946	0.904	0.795	0.900	0.750	0.864	0.890	0.917	0.807	0.913	0.789	0.856	0.918	0.846
Gradient Boosting	0.897	0.686	0.769	0.851	0.890	0.776	0.938	1.000	0.907	0.827	0.811	0.871	0.935	0.896	0.734	0.938	0.921	0.897	0.858	0.891	0.964	1.000	0.890	0.920	0.836	0.950	0.820	0.907	0.980	0.837
Helstrom Quantum Classifier	0.857	0.837	0.618	0.795	0.917	0.727	0.890	0.938	0.964	0.851	0.814	0.885	0.916	0.950	0.756	0.980	0.946	0.904	0.875	0.950	0.857	0.979	0.962	0.833	0.863	0.931	0.812	0.899	0.980	0.896
Linear Discriminant Analysis	0.837	0.857	0.734	0.842	0.917	0.764	0.866	0.938	0.835	0.781	0.789	0.870	0.916	0.900	0.778	0.897	0.971	0.885	0.688	0.850	0.835	0.938	0.825	0.833	0.756	0.881	0.812	0.899	0.940	0.866
Logistic Regression	0.857	0.920	0.651	0.890	0.917	0.753	0.882	0.938	0.871	0.757	0.839	0.899	0.916	0.896	0.778	0.938	0.946	0.885	0.795	0.900	0.792	0.979	0.890	0.917	0.836	0.931	0.820	0.907	0.980	0.891
Multi Layer Perceptron	0.857	0.784	0.801	0.897	0.917	0.776	0.882	0.938	0.885	0.859	0.787	0.907	0.962	0.921	0.863	0.960	0.921	0.923	0.875	0.896	0.871	1.000	0.909	0.920	0.889	0.913	0.789	0.907	0.980	0.891
Nearest Neighbors	0.857	0.668	0.702	0.890	0.917	0.832	0.859	0.976	0.929	0.844	0.867	0.849	0.962	0.921	0.800	0.938	0.946	0.942	0.875	0.921	0.857	0.958	0.935	0.892	0.863	0.881	0.851	0.907	0.980	0.866
Quadratic Discriminant Analysis	0.877	0.760	0.884	0.890	0.889	0.752	0.921	0.914	0.835	0.812	0.893	0.863	0.916	0.896	0.778	0.960	0.971	0.904	0.750	0.841	0.814	0.979	0.935	0.838	0.808	0.913	0.882	0.899	0.980	0.807
Random Forest	0.855	0.784	0.785	0.882	0.917	0.720	0.969	0.945	0.871	0.796	0.839	0.907	0.935	0.925	0.734	0.938	0.946	0.923	0.875	0.866	0.893	1.000	0.890	0.917	0.863	0.913	0.796	0.907	0.980	0.866
SVM - linear	0.857	0.798	0.884	0.897	0.917	0.798	0.859	0.938	0.835	0.757	0.760	0.877	0.916	0.925	0.778	0.938	0.971	0.904	0.795	0.900	0.835	0.979	0.890	0.917	0.863	0.963	0.820	0.907	0.980	0.921
SVM - poly	0.835	0.784	0.817	0.866	0.917	0.786	0.914	0.938	0.893	0.820	0.814	0.893	0.916	0.921	0.778	0.938	0.946	0.897	0.812	0.866	0.842	1.000	0.935	0.944	0.890	0.863	0.851	0.849	0.980	0.896
SVM - rbf	0.857	0.857	0.884	0.695	0.500	0.798	0.914	0.938	0.857	0.789	0.787	0.899	0.916	0.925	0.778	0.938	0.971	0.500	0.795	0.800	0.835	0.979	0.890	0.917	0.836	0.963	0.789	0.907	0.980	0.871

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.8 | AUROC score for 30 L*u*v* image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.825	0.851	0.838	0.943	0.890	0.804	0.895	0.775	0.866	0.878	0.920	0.967	0.795	0.906	0.816	0.643	0.898	0.941	0.871	0.921	0.864	0.921	0.964	0.890	0.952	0.929	0.947	0.885	0.897	0.947
Bernoulli Naive Bayes	0.904	0.866	0.844	0.907	0.906	0.804	0.784	0.750	0.701	0.712	0.918	0.944	0.692	0.859	0.741	0.824	0.932	0.878	0.842	0.941	0.727	0.921	0.899	0.938	0.881	0.871	0.946	0.863	0.918	0.946
Dummy Classifier	0.353	0.500	0.500	0.500	0.560	0.407	0.500	0.500	0.473	0.485	0.500	0.500	0.503	0.400	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.705	0.500	0.464	0.685	0.462	0.604	0.485	0.355
Extra Trees	0.799	0.632	0.500	0.943	0.906	0.784	0.836	0.771	0.859	0.500	0.918	0.967	0.762	0.929	0.850	0.500	0.909	0.979	0.814	0.946	0.778	0.895	0.957	0.914	0.905	0.500	0.974	0.500	0.917	0.920
Gaussian Naive Bayes	0.897	0.796	0.775	0.929	0.938	0.801	0.865	0.796	0.820	0.732	0.918	0.967	0.707	0.882	0.821	0.681	0.932	0.958	0.885	0.941	0.781	0.895	0.957	0.938	0.976	0.821	1.000	0.899	0.958	0.947
Gradient Boosting	0.780	0.749	0.838	0.943	0.914	0.766	0.921	0.825	0.890	0.815	0.867	0.921	0.795	0.835	0.791	0.664	0.832	1.000	0.849	0.891	0.782	0.921	0.964	0.914	0.976	0.871	0.947	0.921	0.938	0.921
Helstrom Quantum Classifier	0.844	0.921	0.838	0.943	0.938	0.822	0.892	0.771	0.890	0.772	0.918	0.967	0.756	0.882	0.707	0.862	0.909	0.941	0.885	0.916	0.807	0.921	0.921	0.938	0.929	0.857	0.946	0.921	0.918	0.974
Linear Discriminant Analysis	0.890	0.890	0.791	0.907	0.906	0.819	0.865	0.750	0.804	0.752	0.917	0.967	0.740	0.906	0.821	0.626	0.909	0.938	0.849	0.921	0.753	0.895	0.935	0.906	0.929	0.821	0.946	0.891	0.938	0.974
Logistic Regression	0.844	0.882	0.938	0.943	0.938	0.804	0.838	0.796	0.811	0.692	0.918	0.967	0.708	0.906	0.821	0.626	0.932	0.958	0.798	0.946	0.781	0.921	0.957	0.938	0.921	0.893	0.946	0.863	0.958	0.974
Multi Layer Perceptron	0.890	0.882	0.822	0.907	0.969	0.804	0.892	0.796	0.897	0.898	0.946	0.911	0.811	0.851	0.796	0.752	0.921	0.902	0.885	0.866	0.838	0.895	0.964	0.914	0.952	0.964	0.946	0.929	0.938	0.946
Nearest Neighbors	0.890	0.882	0.822	0.899	0.938	0.745	0.864	0.800	0.859	0.813	0.944	0.967	0.802	0.882	0.766	0.714	0.898	0.941	0.863	0.837	0.835	0.921	0.921	0.914	0.929	0.929	0.974	0.863	0.918	0.974
Quadratic Discriminant Analysis	0.935	0.757	0.922	0.943	0.906	0.804	0.839	0.825	0.859	0.732	0.918	0.967	0.802	0.906	0.762	0.698	0.932	0.920	0.863	0.891	0.781	0.895	0.978	0.914	0.952	0.857	0.947	0.899	0.938	0.947
Random Forest	0.825	0.851	0.853	0.907	0.938	0.784	0.895	0.796	0.842	0.795	0.946	0.944	0.732	0.859	0.787	0.698	0.898	0.979	0.885	0.921	0.754	0.921	1.000	0.945	0.976	0.871	0.947	0.899	0.938	0.947
SVM - linear	0.890	0.890	0.822	0.907	0.906	0.804	0.839	0.771	0.835	0.753	0.944	0.967	0.723	0.906	0.821	0.698	0.932	0.958	0.842	0.946	0.779	0.921	0.913	0.938	0.952	0.857	0.972	0.877	0.938	0.974
SVM - poly	0.799	0.827	0.838	0.943	0.945	0.843	0.864	0.796	0.827	0.775	0.944	0.933	0.676	0.835	0.821	0.643	0.898	0.787	0.863	0.946	0.838	0.868	0.863	0.969	0.976	0.821	0.972	0.885	0.938	0.974
SVM - rbf	0.890	0.921	0.822	0.929	0.906	0.825	0.867	0.771	0.780	0.733	0.722	0.967	0.762	0.906	0.771	0.698	0.932	0.938	0.842	0.946	0.500	0.895	0.935	0.938	0.952	0.857	0.972	0.899	0.938	0.974

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.9 | AUROC score for 30 contrast image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.835	0.823	0.879	0.918	0.866	0.744	0.929	0.820	0.945	0.943	0.881	0.946	0.863	0.890	0.784	0.800	0.933	0.921	0.909	0.974	0.972	0.975	0.878	0.891	0.955	0.853	1.000	0.874	0.969	0.967
Bernoulli Naive Bayes	0.817	0.657	0.500	0.917	0.765	0.846	0.778	0.888	0.812	0.943	0.882	0.875	0.890	0.839	0.739	0.869	0.933	0.929	0.909	0.918	0.890	0.850	0.784	0.771	0.944	0.824	0.925	0.921	0.699	0.886
Dummy Classifier	0.500	0.500	0.438	0.431	0.500	0.500	0.490	0.500	0.500	0.526	0.500	0.515	0.500	0.567	0.481	0.500	0.373	0.464	0.360	0.563	0.386	0.500	0.500	0.500	0.500	0.500	0.494	0.473	0.473	0.500
Extra Trees	0.500	0.500	0.500	0.917	0.500	0.559	0.938	0.767	0.781	0.679	0.500	0.774	0.500	0.811	0.697	0.500	0.500	0.796	0.500	0.806	0.500	0.724	0.731	0.696	0.867	0.500	1.000	0.762	0.594	0.932
Gaussian Naive Bayes	0.817	0.886	0.862	0.918	0.789	0.782	0.881	0.888	0.875	0.821	0.914	0.975	0.890	0.839	0.878	0.800	0.933	0.945	0.864	0.946	0.841	0.950	0.840	0.796	0.977	0.824	1.000	0.897	1.000	0.955
Gradient Boosting	0.891	0.823	0.879	0.918	0.938	0.719	0.929	0.865	0.897	0.978	0.905	0.946	0.836	0.892	0.819	0.784	0.967	0.890	0.909	0.974	1.000	0.921	0.899	0.866	0.977	0.857	0.941	0.850	1.000	1.000
Helstrom Quantum Classifier	0.911	0.765	0.912	0.944	0.820	0.816	0.881	0.911	0.906	0.929	0.952	0.950	0.836	0.839	0.864	0.784	0.833	0.952	0.909	0.972	0.972	0.896	0.920	0.921	0.967	0.857	1.000	0.945	1.000	0.977
Linear Discriminant Analysis	0.800	0.795	0.643	0.917	0.695	0.807	0.802	0.855	0.844	0.857	0.882	0.900	0.863	0.865	0.801	0.800	0.867	0.842	0.773	0.972	0.762	0.875	0.724	0.771	0.967	0.794	0.950	0.859	0.905	0.909
Logistic Regression	0.873	0.858	0.895	0.890	0.789	0.715	0.787	0.888	0.875	0.907	0.952	0.975	0.890	0.839	0.843	0.800	0.900	0.945	0.818	0.972	0.893	0.950	0.843	0.821	0.977	0.824	0.975	0.929	1.000	0.955
Multi Layer Perceptron	0.891	0.886	0.845	0.890	0.859	0.715	0.897	0.888	0.938	0.964	0.929	0.921	0.836	0.785	0.804	0.800	0.933	0.945	0.909	0.972	0.920	0.950	0.920	0.821	0.944	0.853	0.975	0.857	1.000	0.977
Nearest Neighbors	0.873	0.789	0.895	0.944	0.749	0.782	0.905	0.921	0.906	0.964	0.952	0.946	0.836	0.813	0.846	0.800	0.933	0.929	0.909	0.972	0.946	0.925	0.920	0.921	0.977	0.853	1.000	0.952	0.952	0.955
Quadratic Discriminant Analysis	0.817	0.806	0.719	0.918	0.757	0.837	0.826	0.877	0.851	0.964	0.882	0.946	0.864	0.813	0.798	0.800	0.933	0.945	0.909	0.972	0.867	0.950	0.857	0.746	0.977	0.794	1.000	0.929	0.976	0.955
Random Forest	0.855	0.823	0.895	0.918	0.882	0.799	0.857	0.911	0.969	1.000	0.952	0.975	0.861	0.865	0.804	0.800	0.933	0.945	0.909	0.974	0.972	0.950	0.941	0.896	0.977	0.853	1.000	0.881	1.000	0.977
SVM - linear	0.835	0.823	0.879	0.890	0.765	0.740	0.787	0.888	0.844	0.964	0.929	0.975	0.890	0.865	0.819	0.800	0.900	0.969	0.818	0.972	0.890	0.950	0.825	0.796	0.977	0.794	1.000	0.929	0.976	0.932
SVM - poly	0.835	0.823	0.845	0.917	0.906	0.807	0.914	0.888	0.938	0.943	0.952	0.950	0.836	0.785	0.804	0.800	0.933	0.921	0.909	0.944	0.974	0.900	0.920	0.821	0.977	0.794	1.000	0.905	1.000	0.955
SVM - rbf	0.817	0.823	0.879	0.917	0.796	0.749	0.787	0.888	0.500	0.943	0.952	0.975	0.890	0.839	0.784	0.500	0.500	0.945	0.773	0.500	0.918	0.900	0.864	0.846	0.977	0.794	1.000	0.929	1.000	0.955

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.10 | AUROC score for 30 correlation image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.757	0.583	0.535	0.728	0.801	0.466	0.839	0.589	0.853	0.757	0.565	0.890	0.820	0.863	0.466	0.664	0.897	0.691	0.833	1.000	0.835	0.770	0.750	0.598	0.745	0.863	0.826	0.731	0.717	0.730
Bernoulli Naive Bayes	0.683	0.583	0.500	0.623	0.500	0.467	0.781	0.455	0.502	0.708	0.719	0.586	0.734	0.756	0.421	0.500	0.740	0.784	0.595	0.803	0.425	0.503	0.713	0.674	0.721	0.776	0.818	0.458	0.656	0.730
Dummy Classifier	0.500	0.346	0.519	0.408	0.502	0.500	0.491	0.567	0.500	0.463	0.500	0.580	0.500	0.425	0.500	0.598	0.500	0.612	0.575	0.500	0.500	0.500	0.500	0.500	0.285	0.500	0.440	0.627	0.500	0.461
Extra Trees	0.500	0.500	0.500	0.681	0.500	0.522	0.725	0.557	0.500	0.500	0.626	0.636	0.500	0.607	0.603	0.500	0.664	0.790	0.577	1.000	0.542	0.649	0.750	0.677	0.795	0.500	0.857	0.500	0.500	0.700
Gaussian Naive Bayes	0.813	0.483	0.583	0.678	0.652	0.560	0.754	0.565	0.649	0.814	0.694	0.871	0.781	0.778	0.481	0.648	0.780	0.741	0.668	0.853	0.712	0.770	0.800	0.709	0.816	0.744	0.850	0.710	0.632	0.730
Gradient Boosting	0.850	0.626	0.519	0.946	0.804	0.756	0.867	0.945	0.909	0.892	0.631	0.851	0.789	0.820	0.659	0.719	0.976	0.877	0.840	0.975	0.918	0.756	0.720	0.911	0.843	0.881	0.874	0.958	0.952	0.946
Helstrom Quantum Classifier	0.781	0.633	0.734	0.813	0.819	0.653	0.784	0.778	0.764	0.674	0.649	0.858	0.851	0.727	0.620	0.867	0.914	0.804	0.816	0.946	0.753	0.741	0.820	0.765	0.795	0.844	0.881	0.819	0.914	0.784
Linear Discriminant Analysis	0.813	0.483	0.500	0.652	0.566	0.615	0.754	0.558	0.500	0.681	0.669	0.650	0.882	0.677	0.481	0.576	0.741	0.784	0.553	0.882	0.505	0.640	0.756	0.686	0.816	0.744	0.850	0.500	0.577	0.703
Logistic Regression	0.831	0.483	0.500	0.652	0.545	0.615	0.754	0.558	0.500	0.681	0.669	0.650	0.906	0.655	0.481	0.433	0.741	0.784	0.553	0.971	0.505	0.640	0.778	0.686	0.837	0.763	0.850	0.500	0.570	0.703
Multi Layer Perceptron	0.763	0.633	0.785	0.838	0.745	0.747	0.784	0.881	0.500	0.709	0.585	0.871	0.820	0.828	0.739	0.790	0.741	0.913	0.861	1.000	0.940	0.733	0.806	0.877	0.899	0.844	0.850	0.917	0.906	0.807
Nearest Neighbors	0.781	0.620	0.685	0.787	0.784	0.747	0.728	0.850	0.835	0.785	0.757	0.844	0.882	0.792	0.620	0.845	0.914	0.913	0.875	0.891	0.775	0.877	0.770	0.788	0.816	0.763	0.850	0.784	0.906	0.732
Quadratic Discriminant Analysis	0.681	0.502	0.583	0.816	0.673	0.512	0.782	0.692	0.742	0.811	0.690	0.787	0.882	0.713	0.540	0.736	0.882	0.848	0.787	0.971	0.568	0.669	0.713	0.642	0.795	0.776	0.850	0.798	0.789	0.703
Random Forest	0.850	0.589	0.535	0.920	0.843	0.708	0.867	0.795	0.853	0.838	0.635	0.851	0.789	0.885	0.679	0.610	0.969	0.935	0.920	1.000	0.815	0.699	0.742	0.844	0.819	0.881	0.850	0.958	0.969	0.865
SVM - linear	0.750	0.502	0.500	0.652	0.500	0.591	0.782	0.558	0.500	0.500	0.690	0.605	0.875	0.748	0.442	0.500	0.710	0.828	0.500	0.853	0.547	0.689	0.800	0.653	0.837	0.744	0.850	0.500	0.500	0.730
SVM - poly	0.676	0.589	0.852	0.810	0.822	0.749	0.756	0.818	0.817	0.785	0.594	0.871	0.851	0.877	0.718	0.681	0.976	0.834	0.896	0.891	0.795	0.776	0.792	0.855	0.899	0.763	0.850	0.917	0.851	0.782
SVM - rbf	0.750	0.483	0.500	0.705	0.566	0.500	0.727	0.565	0.500	0.579	0.500	0.689	0.750	0.748	0.460	0.500	0.772	0.863	0.668	0.853	0.545	0.668	0.800	0.653	0.857	0.813	0.826	0.500	0.500	0.730

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.11 | AUROC score for 30 energy image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.871	0.885	0.857	0.929	1.000	0.836	0.943	1.000	0.788	0.866	0.978	0.971	0.969	0.944	0.890	0.920	0.935	0.929	1.000	0.972	0.976	0.946	0.980	0.943	0.975	0.909	0.947	0.888	0.964	0.958
Bernoulli Naive Bayes	0.944	0.846	0.967	0.821	0.833	0.861	0.848	0.781	0.725	0.850	0.857	0.950	0.938	0.933	0.841	0.528	0.916	0.833	0.804	0.865	0.881	0.875	0.708	0.821	0.900	0.818	0.921	0.886	0.964	0.917
Dummy Classifier	0.417	0.500	0.500	0.705	0.434	0.500	0.568	0.496	0.567	0.500	0.500	0.565	0.500	0.500	0.544	0.532	0.250	0.363	0.500	0.500	0.500	0.535	0.500	0.547	0.500	0.638	0.500	0.417	0.505	0.500
Extra Trees	0.833	0.500	0.500	0.543	0.579	0.806	0.856	0.740	0.500	0.588	0.907	0.971	0.897	0.877	0.892	0.688	0.909	0.944	0.500	0.864	0.500	0.896	0.875	0.679	0.850	0.500	0.944	0.500	0.821	0.917
Gaussian Naive Bayes	0.944	0.885	0.840	0.893	0.944	0.889	0.899	1.000	0.839	0.816	0.929	1.000	0.969	0.944	0.867	0.688	0.981	0.946	1.000	0.892	0.976	0.941	0.917	0.964	1.000	0.890	0.974	0.932	1.000	0.938
Gradient Boosting	0.927	0.846	0.929	0.842	0.972	0.863	0.921	1.000	0.839	0.812	0.978	0.971	0.969	0.944	0.811	0.920	0.962	0.929	1.000	0.946	1.000	0.950	0.958	0.943	0.975	1.000	0.921	0.855	0.957	0.958
Helstrom Quantum Classifier	0.927	0.846	0.786	0.893	0.946	1.000	0.921	0.969	0.865	0.866	0.929	1.000	0.969	0.921	0.814	0.983	0.981	0.927	0.804	0.947	1.000	0.946	0.958	0.893	1.000	0.942	0.946	0.955	0.964	0.917
Linear Discriminant Analysis	0.778	0.846	0.786	0.893	0.944	0.861	0.935	0.812	0.728	0.846	0.893	0.950	0.976	0.911	0.867	0.500	0.916	0.778	0.935	0.892	0.945	0.846	0.917	0.857	0.900	0.773	0.867	0.864	0.893	0.896
Logistic Regression	0.944	0.885	0.786	0.893	1.000	0.889	0.921	0.906	0.867	0.841	0.929	1.000	0.969	0.944	0.893	0.858	0.981	0.929	0.957	0.893	0.945	0.971	0.958	0.893	0.975	1.000	0.974	0.898	0.978	0.938
Multi Layer Perceptron	0.909	0.885	0.857	0.893	0.972	0.889	0.943	0.969	0.813	0.921	0.907	0.971	0.969	0.944	0.867	0.983	0.981	0.909	0.957	0.972	0.938	0.946	0.958	0.943	0.975	0.935	0.974	0.888	0.943	0.938
Nearest Neighbors	0.964	0.825	0.857	0.871	0.946	0.944	0.921	0.969	0.865	0.950	0.929	1.000	0.938	0.921	0.788	0.983	0.981	0.944	0.957	0.946	0.969	0.971	0.958	0.964	1.000	0.962	0.920	0.955	0.964	0.938
Quadratic Discriminant Analysis	0.944	0.885	0.840	0.893	0.944	0.889	0.899	1.000	0.839	0.841	0.907	0.971	0.969	0.944	0.841	0.688	0.981	0.946	1.000	0.892	0.976	0.941	0.958	0.964	1.000	0.935	0.974	0.932	1.000	0.958
Random Forest	0.927	0.923	0.857	0.964	1.000	0.917	0.943	1.000	0.867	0.866	0.943	0.971	0.969	0.944	0.865	0.938	0.981	0.946	1.000	0.946	0.945	0.941	0.958	0.943	0.975	0.955	0.974	0.888	1.000	0.958
SVM - linear	0.944	0.885	0.786	0.893	1.000	0.889	0.899	0.875	0.839	0.866	0.907	0.950	0.969	0.944	0.867	0.858	0.981	0.815	0.935	0.920	0.945	0.925	0.917	0.893	0.950	0.955	0.974	0.932	0.964	0.938
SVM - poly	0.927	0.825	0.786	0.857	0.944	0.946	0.957	0.938	0.839	0.900	0.964	1.000	0.969	0.888	0.841	0.983	0.897	0.909	0.913	0.920	0.969	0.946	0.958	0.929	0.975	0.864	0.947	0.886	0.943	0.979
SVM - rbf	0.889	0.500	0.500	0.893	1.000	0.889	0.921	1.000	0.811	0.866	0.929	0.875	0.969	0.944	0.867	0.858	0.981	0.946	0.500	0.920	0.976	0.925	0.958	0.750	0.975	0.955	0.974	0.898	0.964	0.938

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.12 | AUROC score for 30 homogeneity image feature datasets for cell line MDA-MD-231

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	0.920	0.950	1.000	0.911	0.977	0.891	0.911	0.832	0.882	0.918	0.955	0.916	0.941	0.838	0.840	1.000	0.971	1.000	1.000	0.929	0.947	0.955	0.971	1.000	0.977	0.974	0.957	0.945	0.975
Bernoulli Naive Bayes	0.979	0.958	0.736	1.000	0.921	0.977	0.950	0.921	0.842	0.896	0.890	1.000	0.921	0.971	0.947	0.862	0.921	0.971	0.942	0.969	1.000	0.947	0.955	1.000	0.944	0.865	0.946	0.978	0.976	1.000
Dummy Classifier	0.500	0.500	0.526	0.467	0.500	0.462	0.401	0.500	0.529	0.500	0.379	0.629	0.500	0.490	0.570	0.500	0.461	0.500	0.437	0.500	0.540	0.458	0.500	0.500	0.500	0.500	0.500	0.604	0.500	0.456
Extra Trees	0.846	0.500	0.500	1.000	0.767	0.900	0.812	0.842	0.865	0.794	0.893	1.000	0.946	0.971	0.947	0.500	1.000	0.912	0.545	1.000	0.643	0.972	1.000	0.853	0.944	0.767	0.972	0.739	0.969	0.706
Gaussian Naive Bayes	1.000	1.000	0.967	1.000	0.821	0.977	0.946	0.921	0.865	0.912	0.890	0.977	0.891	0.971	0.947	0.895	1.000	0.971	1.000	1.000	0.964	0.946	0.955	1.000	0.944	0.977	0.974	0.957	0.945	1.000
Gradient Boosting	0.958	0.938	0.950	1.000	0.944	0.977	0.891	0.888	0.865	0.853	0.918	0.955	0.891	0.912	0.865	0.895	0.978	0.971	1.000	0.945	0.929	0.947	0.955	0.971	0.967	0.955	0.974	0.899	0.914	0.941
Helstrom Quantum Classifier	0.962	0.979	0.950	1.000	0.900	0.977	0.946	0.911	0.774	0.916	0.920	1.000	0.891	1.000	0.947	0.967	1.000	0.971	1.000	1.000	1.000	0.974	0.955	1.000	1.000	0.955	0.946	0.957	0.976	0.853
Linear Discriminant Analysis	1.000	0.923	0.983	1.000	0.821	1.000	0.946	0.909	0.865	0.912	0.890	1.000	0.862	0.971	0.947	0.895	1.000	0.971	1.000	1.000	1.000	0.947	0.955	1.000	1.000	0.955	0.974	0.978	0.945	1.000
Logistic Regression	1.000	0.920	1.000	1.000	0.833	0.977	0.946	0.898	0.865	0.912	0.890	0.977	0.921	0.971	0.920	0.879	1.000	0.971	0.955	1.000	0.964	0.947	0.932	1.000	0.967	0.977	0.974	0.957	0.945	1.000
Multi Layer Perceptron	0.941	0.958	0.967	1.000	0.900	0.977	0.891	0.898	0.865	0.887	0.890	1.000	0.921	0.941	0.974	0.879	0.978	0.971	1.000	1.000	0.964	0.947	0.898	1.000	0.967	0.886	0.974	0.957	0.976	0.971
Nearest Neighbors	0.923	0.962	0.950	1.000	0.933	0.977	0.916	0.955	0.865	0.882	0.920	1.000	0.950	0.912	0.893	0.895	0.978	0.971	1.000	1.000	1.000	0.974	0.955	1.000	1.000	0.977	0.974	0.978	0.969	0.971
Quadratic Discriminant Analysis	1.000	0.902	0.950	1.000	0.900	0.977	0.921	0.944	0.865	0.941	0.890	0.977	0.921	1.000	0.947	0.895	1.000	0.971	1.000	1.000	1.000	0.947	0.932	1.000	0.967	0.955	0.974	0.957	0.976	1.000
Random Forest	1.000	0.938	0.950	1.000	0.877	0.977	0.921	0.911	0.865	0.882	0.892	0.955	0.921	0.941	0.920	0.840	0.978	0.971	1.000	1.000	0.929	0.947	0.955	1.000	0.967	0.977	0.974	0.957	0.945	1.000
SVM - linear	1.000	0.923	1.000	1.000	0.833	0.977	0.946	0.898	0.865	0.912	0.890	0.955	0.950	1.000	0.920	0.912	1.000	0.971	0.955	1.000	0.929	0.947	0.955	1.000	0.967	0.977	0.974	0.957	0.976	1.000
SVM - poly	0.923	0.979	1.000	1.000	0.877	0.977	0.946	0.921	0.795	0.912	0.890	0.977	0.950	0.941	0.974	0.840	1.000	0.971	1.000	0.976	0.964	0.947	0.977	0.971	0.967	0.977	0.974	0.957	0.969	0.941
SVM - rbf	1.000	0.881	0.500	1.000	0.500	0.500	0.916	0.898	0.865	0.912	0.890	0.977	0.921	0.971	0.920	0.500	0.500	0.971	0.955	1.000	0.929	0.920	0.500	1.000	0.967	0.977	0.974	0.957	0.500	1.000

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.13 | Balanced accuracy score for 30 RGB image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.891	0.920	0.875	0.781	0.719	0.806	0.877	0.753	0.866	0.770	0.851	0.756	0.721	0.709	0.733	0.979	0.699	0.653	0.877	0.832	0.792	0.868	0.911	0.784	0.569	0.484	0.774	0.813	0.704	0.897
Bernoulli Naive Bayes	0.907	0.772	0.773	0.831	0.636	0.780	0.693	0.916	0.827	0.590	0.935	0.763	0.788	0.709	0.793	0.885	0.707	0.713	0.855	0.755	0.733	0.762	0.855	0.539	0.653	0.722	0.774	0.650	0.724	0.897
Dummy Classifier	0.500	0.500	0.500	0.602	0.500	0.411	0.528	0.500	0.466	0.500	0.516	0.543	0.500	0.500	0.500	0.500	0.506	0.675	0.500	0.360	0.505	0.500	0.429	0.500	0.522	0.406	0.500	0.500	0.500	0.490
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.591	0.844	0.500	0.753	0.612	0.644	0.500	0.813	0.808	0.500	0.653	0.813	0.500	0.500	0.684	0.667	0.542	0.500	0.500	0.500	0.500	0.556	0.844
Gaussian Naive Bayes	0.786	0.806	0.710	0.750	0.626	0.734	0.668	0.851	0.827	0.671	0.844	0.707	0.677	0.716	0.772	0.808	0.662	0.753	0.813	0.657	0.813	0.737	0.933	0.564	0.700	0.553	0.664	0.668	0.667	0.890
Gradient Boosting	0.913	0.869	0.833	0.781	0.807	0.806	0.815	0.916	0.921	0.792	0.916	0.840	0.788	0.709	0.753	0.923	0.787	0.775	0.835	0.897	0.875	0.813	0.933	0.782	0.684	0.484	0.824	0.753	0.722	0.921
Helstrom Quantum Classifier	0.826	0.834	0.815	0.881	0.824	0.851	0.752	0.897	0.897	0.734	0.935	0.801	0.788	0.692	0.775	0.923	0.766	0.777	0.833	0.832	0.795	0.788	0.867	0.756	0.669	0.638	0.807	0.692	0.688	0.882
Linear Discriminant Analysis	0.821	0.903	0.833	0.750	0.643	0.689	0.772	0.773	0.765	0.742	0.844	0.780	0.733	0.653	0.813	0.885	0.644	0.690	0.833	0.799	0.772	0.788	0.900	0.724	0.600	0.484	0.698	0.668	0.667	0.882
Logistic Regression	0.871	0.886	0.813	0.750	0.643	0.741	0.773	0.818	0.921	0.742	0.916	0.819	0.711	0.716	0.813	0.885	0.669	0.753	0.813	0.844	0.752	0.816	0.900	0.699	0.600	0.484	0.698	0.690	0.722	0.945
Multi Layer Perceptron	0.957	0.869	0.813	0.644	0.790	0.767	0.712	0.844	0.921	0.762	0.916	0.819	0.755	0.698	0.795	1.000	0.757	0.775	0.833	0.897	0.752	0.865	0.900	0.731	0.438	0.684	0.807	0.733	0.631	0.914
Nearest Centroid	0.921	0.772	0.773	0.844	0.652	0.696	0.653	0.871	0.897	0.626	0.962	0.784	0.720	0.709	0.795	0.885	0.707	0.713	0.813	0.781	0.835	0.706	0.877	0.461	0.700	0.553	0.686	0.610	0.669	0.850
Nearest Neighbors	0.913	0.823	0.813	0.763	0.736	0.825	0.732	0.799	0.890	0.713	0.787	0.801	0.844	0.698	0.817	0.958	0.703	0.735	0.855	0.858	0.855	0.841	0.765	0.785	0.569	0.684	0.698	0.672	0.651	0.906
Passive Aggressive Classifier	0.978	0.817	0.875	0.631	0.681	0.741	0.773	0.727	0.890	0.691	0.820	0.780	0.765	0.675	0.675	0.792	0.463	0.713	0.777	0.573	0.730	0.730	0.855	0.621	0.506	0.569	0.719	0.612	0.744	0.738
Perceptron	0.943	0.869	0.855	0.831	0.598	0.794	0.835	0.677	0.897	0.742	0.806	0.822	0.664	0.446	0.813	0.920	0.787	0.710	0.793	0.755	0.710	0.756	0.865	0.545	0.481	0.606	0.500	0.240	0.657	0.844
Quadratic Discriminant Analysis	0.907	0.851	0.875	0.731	0.643	0.767	0.793	0.871	0.835	0.742	0.890	0.763	0.711	0.636	0.793	0.885	0.746	0.712	0.833	0.844	0.855	0.787	0.911	0.725	0.484	0.569	0.769	0.668	0.760	0.844
Random Forest	0.957	0.886	0.833	0.781	0.824	0.760	0.835	0.825	0.929	0.756	0.890	0.840	0.788	0.709	0.753	1.000	0.762	0.753	0.835	0.851	0.875	0.841	0.933	0.757	0.600	0.484	0.895	0.690	0.538	0.921
SVM - linear	0.821	0.841	0.855	0.750	0.643	0.741	0.793	0.773	0.835	0.742	0.916	0.840	0.767	0.716	0.813	0.846	0.699	0.753	0.813	0.844	0.813	0.842	0.855	0.699	0.700	0.484	0.698	0.690	0.722	0.914
SVM - poly	0.921	0.869	0.855	0.639	0.752	0.832	0.813	0.825	0.866	0.756	0.774	0.819	0.744	0.716	0.732	1.000	0.757	0.818	0.833	0.825	0.857	0.759	0.933	0.810	0.538	0.584	0.840	0.630	0.651	0.938
SVM - rbf	0.893	0.841	0.875	0.731	0.643	0.741	0.813	0.773	0.897	0.756	0.916	0.840	0.744	0.716	0.813	0.923	0.707	0.733	0.813	0.844	0.813	0.842	0.855	0.699	0.600	0.484	0.698	0.690	0.722	0.882

Table 4.14 | Balanced accuracy score for 30 L*u*v* image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.793	0.875	0.931	0.863	0.571	0.804	0.770	0.800	0.841	0.704	0.861	0.822	0.760	0.807	0.556	0.861	0.721	0.813	0.810	0.775	0.881	0.882	0.815	0.832	0.684	0.735	0.664	0.685	0.804	0.832
Bernoulli Naive Bayes	0.710	0.830	0.863	0.826	0.769	0.692	0.835	0.826	0.846	0.769	0.902	0.801	0.599	0.803	0.685	0.902	0.655	0.895	0.728	0.753	0.826	0.756	0.946	0.729	0.853	0.735	0.761	0.635	0.881	0.832
Dummy Classifier	0.500	0.549	0.500	0.500	0.500	0.500	0.500	0.707	0.500	0.508	0.446	0.484	0.500	0.500	0.635	0.500	0.502	0.759	0.500	0.467	0.483	0.622	0.500	0.608	0.500	0.439	0.504	0.500	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.538	0.571	0.500	0.825	0.500	0.787	0.710	0.500	0.676	0.529	0.846	0.697	0.816	0.645	0.667	0.550	0.789	0.778	0.638	0.500	0.500	0.500	0.500	0.500	0.799
Gaussian Naive Bayes	0.750	0.610	0.881	0.713	0.643	0.577	0.786	0.881	0.821	0.748	0.902	0.784	0.632	0.710	0.563	0.769	0.652	0.868	0.756	0.753	0.844	0.804	0.909	0.671	0.669	0.735	0.841	0.660	0.787	0.828
Gradient Boosting	0.813	0.985	0.950	0.794	0.840	0.846	0.814	0.931	0.916	0.769	0.881	0.840	0.680	0.690	0.681	0.920	0.763	0.839	0.838	0.817	0.794	0.796	0.927	0.776	0.969	0.610	0.886	0.685	0.941	0.862
Helstrom Quantum Classifier	0.813	0.970	0.913	0.844	0.702	0.787	0.719	0.826	0.925	0.843	0.843	0.784	0.654	0.778	0.656	0.923	0.700	0.867	0.728	0.775	0.857	0.882	0.889	0.842	0.922	0.784	0.744	0.660	0.819	0.887
Linear Discriminant Analysis	0.750	0.750	0.800	0.700	0.643	0.538	0.671	0.850	0.775	0.769	0.846	0.748	0.604	0.681	0.568	0.885	0.715	0.813	0.728	0.833	0.863	0.741	0.833	0.673	0.700	0.625	0.761	0.706	0.731	0.824
Logistic Regression	0.750	0.750	0.850	0.813	0.643	0.538	0.778	0.831	0.896	0.769	0.902	0.825	0.604	0.656	0.597	0.885	0.718	0.893	0.757	0.733	0.913	0.772	0.889	0.729	0.700	0.610	0.761	0.685	0.731	0.853
Multi Layer Perceptron	0.855	1.000	0.831	0.781	0.555	0.689	0.792	0.950	0.975	0.763	0.881	0.825	0.576	0.774	0.665	0.885	0.718	0.838	0.785	0.795	0.913	0.827	0.944	0.830	0.953	0.735	0.789	0.685	0.979	0.841
Nearest Centroid	0.690	0.845	0.863	0.826	0.790	0.654	0.871	0.844	0.875	0.704	0.843	0.801	0.678	0.832	0.656	0.846	0.620	0.921	0.673	0.753	0.794	0.787	0.853	0.695	0.669	0.735	0.737	0.660	0.861	0.837
Nearest Neighbors	0.795	0.595	0.863	0.763	0.610	0.748	0.778	0.813	0.896	0.808	0.822	0.745	0.839	0.862	0.669	0.878	0.801	0.917	0.754	0.753	0.707	0.811	0.889	0.832	0.753	0.705	0.761	0.765	0.902	0.841
Passive Aggressive Classifier	0.750	0.735	0.839	0.844	0.807	0.748	0.750	0.826	0.812	0.825	0.798	0.760	0.577	0.699	0.538	0.769	0.609	0.838	0.652	0.857	0.894	0.772	0.855	0.497	0.753	0.735	0.636	0.685	0.710	0.799
Perceptron	0.752	0.735	0.813	0.850	0.500	0.654	0.800	0.881	0.774	0.662	0.881	0.780	0.652	0.812	0.568	0.689	0.665	0.865	0.785	0.878	0.802	0.558	0.909	0.452	0.753	0.735	0.595	0.635	0.840	0.816
Quadratic Discriminant Analysis	0.750	0.735	0.831	0.694	0.571	0.577	0.786	0.813	0.821	0.787	0.902	0.861	0.604	0.735	0.538	0.787	0.635	0.867	0.838	0.753	0.863	0.710	0.927	0.694	0.600	0.750	0.726	0.685	0.808	0.857
Random Forest	0.772	0.735	0.913	0.863	0.714	0.808	0.849	0.881	0.916	0.846	0.861	0.822	0.627	0.803	0.681	0.864	0.644	0.893	0.839	0.775	0.863	0.882	0.889	0.821	0.753	0.750	0.806	0.685	0.941	0.832
SVM - linear	0.750	0.750	0.900	0.794	0.571	0.577	0.764	0.831	0.846	0.769	0.881	0.804	0.576	0.740	0.597	0.885	0.718	0.865	0.700	0.753	0.913	0.772	0.833	0.752	0.600	0.735	0.778	0.685	0.846	0.853
SVM - poly	0.835	0.860	0.800	0.763	0.610	0.748	0.835	0.863	0.828	0.668	0.784	0.784	0.575	0.916	0.606	0.843	0.756	0.917	0.730	0.775	0.876	0.749	0.778	0.764	0.753	0.610	0.789	0.685	0.843	0.749
SVM - rbf	0.750	0.750	0.850	0.844	0.571	0.615	0.786	0.831	0.846	0.731	0.881	0.825	0.576	0.740	0.593	0.885	0.718	0.893	0.757	0.753	0.913	0.772	0.944	0.729	0.684	0.625	0.778	0.685	0.846	0.828

Table 4.15 | Balanced accuracy score for 30 contrast image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.897	1.000	0.946	0.800	0.806	0.898	0.946	0.863	0.887	0.923	0.921	0.893	0.777	0.814	0.812	0.742	0.826	0.835	0.842	0.844	0.885	0.890	0.780	0.850	0.879	0.807	0.752	0.897	0.800	0.810
Bernoulli Naive Bayes	0.813	0.931	0.927	0.950	0.841	0.875	0.918	0.831	0.857	0.885	0.907	0.697	0.844	0.893	0.757	0.732	0.738	0.780	0.871	0.781	0.921	0.844	0.843	0.844	0.955	0.807	0.752	0.820	0.900	0.725
Dummy Classifier	0.547	0.500	0.577	0.500	0.500	0.500	0.648	0.589	0.574	0.452	0.613	0.509	0.339	0.500	0.500	0.495	0.500	0.470	0.475	0.500	0.500	0.488	0.449	0.417	0.564	0.500	0.500	0.500	0.500	0.564
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.853	0.500	0.500	0.556	0.500	0.500	0.529	0.600	0.531	0.500	0.500	0.500	0.500	0.667	0.500	0.820	0.500	0.500	0.500	0.500	0.500	0.611
Gaussian Naive Bayes	0.605	1.000	0.833	0.700	0.625	0.833	0.779	0.731	0.857	0.923	0.835	0.808	0.777	0.800	0.719	0.721	0.786	0.704	0.885	0.750	0.885	0.851	0.731	0.789	0.735	0.824	0.688	0.757	0.650	0.808
Gradient Boosting	0.793	1.000	0.964	0.813	0.761	0.940	0.835	0.781	0.862	0.958	0.921	0.920	0.844	0.899	0.841	0.798	0.881	0.762	0.863	0.844	0.885	0.890	0.843	0.835	0.845	0.879	0.793	0.818	0.831	0.782
Helstrom Quantum Classifier	0.773	0.963	0.891	0.813	0.823	0.980	0.918	0.863	0.857	0.979	0.921	0.836	0.855	0.776	0.757	0.832	0.881	0.762	0.877	0.950	0.907	0.818	0.840	0.882	0.924	0.950	0.730	0.835	0.863	0.861
Linear Discriminant Analysis	0.563	0.850	0.833	0.650	0.625	0.792	0.724	0.750	0.857	0.846	0.764	0.722	0.744	0.764	0.660	0.721	0.787	0.704	0.834	0.700	0.764	0.725	0.692	0.820	0.735	0.824	0.647	0.695	0.600	0.806
Logistic Regression	0.730	0.950	0.889	0.650	0.608	0.875	0.918	0.781	0.857	0.941	0.871	0.864	0.777	0.800	0.782	0.765	0.881	0.724	0.899	0.800	0.885	0.890	0.731	0.811	0.735	0.824	0.688	0.851	0.650	0.808
Multi Layer Perceptron	0.835	0.950	0.964	0.781	0.841	0.940	0.890	0.831	0.857	0.941	0.907	0.892	0.877	0.849	0.812	0.809	0.787	0.835	0.877	0.781	0.849	0.818	0.861	0.882	0.970	0.879	0.710	0.835	0.763	0.808
Nearest Centroid	0.813	0.876	0.946	0.757	0.778	0.835	0.946	0.863	0.837	0.902	0.806	0.673	0.877	0.863	0.732	0.709	0.810	0.760	0.834	0.781	0.748	0.851	0.843	0.772	0.659	0.807	0.772	0.882	0.894	0.779
Nearest Neighbors	0.855	0.950	0.833	0.800	0.823	0.938	0.890	0.881	0.857	0.923	0.863	0.863	0.921	0.792	0.782	0.738	0.826	0.835	0.863	0.850	0.871	0.826	0.822	0.882	0.985	0.879	0.710	0.842	0.750	0.864
Passive Aggressive Classifier	0.793	0.900	0.819	0.600	0.733	0.958	0.861	0.752	0.857	0.748	0.849	0.893	0.898	0.728	0.619	0.765	0.750	0.780	0.834	0.750	0.814	0.802	0.692	0.612	0.860	0.824	0.628	0.820	0.700	0.808
Perceptron	0.710	1.000	0.909	0.700	0.608	0.875	0.918	0.826	0.857	0.941	0.907	0.836	0.700	0.800	0.737	0.720	0.656	0.780	0.842	0.781	0.814	0.875	0.500	0.685	0.659	0.824	0.835	0.670	0.500	0.781
Quadratic Discriminant Analysis	0.625	1.000	0.889	0.700	0.625	0.833	0.779	0.800	0.857	0.962	0.907	0.808	0.777	0.764	0.719	0.721	0.786	0.760	0.921	0.750	0.885	0.780	0.692	0.851	0.610	0.824	0.688	0.757	0.600	0.781
Random Forest	0.855	0.950	0.982	0.800	0.858	0.940	0.918	0.831	0.862	0.881	0.907	0.946	0.877	0.814	0.841	0.776	0.826	0.835	0.877	0.781	0.885	0.914	0.902	0.835	0.970	0.807	0.752	0.897	0.800	0.810
SVM - linear	0.772	0.900	0.889	0.700	0.733	0.958	0.918	0.781	0.832	0.962	0.871	0.810	0.777	0.835	0.812	0.765	0.857	0.835	0.877	0.781	0.885	0.945	0.748	0.811	0.845	0.824	0.688	0.851	0.700	0.808
SVM - poly	0.813	0.950	0.927	0.844	0.812	0.918	0.918	0.863	0.857	0.923	0.835	0.864	0.877	0.871	0.799	0.809	0.857	0.780	0.899	0.813	0.849	0.795	0.899	0.851	0.970	0.790	0.668	0.780	0.900	0.702
SVM - rbf	0.813	0.900	0.889	0.700	0.733	1.000	0.918	0.831	0.832	0.962	0.871	0.810	0.777	0.835	0.724	0.765	0.857	0.780	0.877	0.781	0.885	0.945	0.710	0.811	0.845	0.824	0.688	0.851	0.700	0.808

Table 4.16 | Balanced accuracy score for 30 correlation image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.750	0.794	0.744	0.806	0.760	0.772	0.700	0.769	0.842	0.710	0.670	0.744	0.721	0.753	0.565	0.716	0.557	0.814	0.754	0.734	0.726	0.732	0.898	0.631	0.483	0.638	0.677	0.878	0.734	0.724
Bernoulli Naive Bayes	0.781	0.851	0.655	0.545	0.500	0.500	0.697	0.551	0.688	0.726	0.605	0.644	0.585	0.702	0.525	0.644	0.532	0.570	0.614	0.631	0.601	0.632	0.647	0.661	0.500	0.669	0.520	0.621	0.685	0.803
Dummy Classifier	0.500	0.573	0.615	0.500	0.430	0.500	0.537	0.505	0.500	0.500	0.547	0.500	0.500	0.491	0.500	0.424	0.500	0.469	0.500	0.547	0.500	0.440	0.467	0.552	0.390	0.500	0.354	0.500	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.528	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.542	0.643	0.500	0.500	0.500	0.500	0.500	0.622	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.710
Gaussian Naive Bayes	0.700	0.753	0.706	0.591	0.643	0.730	0.699	0.618	0.665	0.695	0.587	0.611	0.606	0.753	0.607	0.644	0.532	0.707	0.699	0.820	0.695	0.707	0.752	0.624	0.500	0.669	0.635	0.729	0.702	0.832
Gradient Boosting	0.800	0.864	0.800	0.670	0.832	0.813	0.753	0.952	0.842	0.616	0.773	0.867	0.686	0.702	0.798	0.810	0.757	0.828	0.702	0.825	0.781	0.728	0.918	0.725	0.545	0.653	0.820	0.755	0.750	0.749
Helstrom Quantum Classifier	0.913	0.897	0.857	0.657	0.671	0.817	0.781	0.852	0.809	0.686	0.737	0.855	0.579	0.725	0.697	0.914	0.699	0.720	0.785	0.762	0.765	0.653	0.920	0.677	0.640	0.644	0.725	0.736	0.753	0.724
Linear Discriminant Analysis	0.531	0.773	0.688	0.573	0.572	0.585	0.728	0.618	0.598	0.695	0.545	0.677	0.630	0.702	0.587	0.723	0.507	0.627	0.697	0.878	0.609	0.707	0.690	0.528	0.500	0.653	0.585	0.593	0.602	0.774
Logistic Regression	0.531	0.773	0.688	0.591	0.526	0.585	0.728	0.618	0.598	0.695	0.545	0.644	0.630	0.702	0.587	0.699	0.507	0.627	0.697	0.878	0.609	0.707	0.690	0.528	0.500	0.653	0.585	0.593	0.602	0.744
Multi Layer Perceptron	0.731	0.851	0.744	0.789	0.696	0.775	0.753	0.753	0.865	0.757	0.737	0.821	0.526	0.699	0.737	0.866	0.674	0.697	0.700	0.897	0.664	0.719	0.878	0.725	0.636	0.584	0.834	0.612	0.833	0.703
Nearest Centroid	0.844	0.878	0.692	0.657	0.671	0.677	0.730	0.688	0.764	0.677	0.737	0.742	0.617	0.753	0.552	0.780	0.544	0.539	0.757	0.820	0.686	0.682	0.755	0.622	0.498	0.675	0.626	0.659	0.672	0.891
Nearest Neighbors	0.813	0.780	0.762	0.761	0.696	0.837	0.781	0.801	0.820	0.702	0.857	0.877	0.603	0.838	0.713	0.874	0.619	0.762	0.677	0.839	0.686	0.753	0.898	0.756	0.744	0.638	0.806	0.626	0.868	0.703
Passive Aggressive Classifier	0.583	0.878	0.500	0.573	0.526	0.480	0.592	0.567	0.642	0.567	0.445	0.688	0.750	0.753	0.533	0.500	0.500	0.661	0.725	0.677	0.749	0.565	0.673	0.561	0.636	0.644	0.500	0.476	0.435	0.703
Perceptron	0.857	0.846	0.694	0.606	0.657	0.545	0.620	0.559	0.632	0.600	0.673	0.765	0.606	0.760	0.482	0.653	0.499	0.512	0.700	0.657	0.644	0.682	0.630	0.560	0.500	0.500	0.562	0.654	0.484	0.762
Quadratic Discriminant Analysis	0.681	0.753	0.671	0.591	0.643	0.710	0.697	0.602	0.586	0.781	0.630	0.677	0.627	0.702	0.628	0.644	0.532	0.649	0.727	0.878	0.640	0.762	0.753	0.662	0.562	0.669	0.685	0.528	0.618	0.719
Random Forest	0.800	0.844	0.706	0.608	0.806	0.855	0.753	0.968	0.876	0.695	0.753	0.811	0.647	0.727	0.797	0.833	0.728	0.770	0.697	0.916	0.757	0.703	0.918	0.765	0.562	0.684	0.756	0.787	0.801	0.782
SVM - linear	0.500	0.780	0.706	0.608	0.500	0.500	0.728	0.500	0.598	0.695	0.565	0.611	0.500	0.728	0.587	0.692	0.503	0.500	0.700	0.813	0.577	0.707	0.690	0.521	0.500	0.500	0.500	0.547	0.602	0.774
SVM - poly	0.831	0.864	0.835	0.556	0.787	0.837	0.703	0.621	0.898	0.719	0.797	0.742	0.582	0.808	0.755	0.890	0.607	0.713	0.700	0.916	0.734	0.703	0.753	0.693	0.761	0.653	0.691	0.626	0.868	0.782
SVM - rbf	0.500	0.799	0.706	0.625	0.500	0.500	0.782	0.583	0.598	0.656	0.565	0.577	0.500	0.754	0.587	0.740	0.532	0.571	0.700	0.878	0.577	0.707	0.690	0.600	0.500	0.500	0.500	0.605	0.602	0.774

Table 4.17 | Balanced accuracy score for 30 energy image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.927	0.940	0.984	0.852	0.752	0.920	0.977	0.760	0.979	0.772	0.863	0.933	0.778	0.920	0.938	0.849	0.856	0.875	0.933	1.000	0.835	0.877	0.820	0.878	0.833	0.971	0.818	0.878	0.700	0.921
Bernoulli Naive Bayes	0.762	0.898	0.953	0.820	0.500	0.828	0.886	0.651	0.846	0.842	0.863	0.820	0.748	0.886	0.591	0.863	0.703	0.825	0.708	0.522	0.692	0.798	0.671	0.900	0.500	0.985	0.710	0.833	0.684	0.841
Dummy Classifier	0.560	0.500	0.528	0.500	0.442	0.500	0.518	0.500	0.500	0.500	0.500	0.500	0.500	0.578	0.659	0.500	0.452	0.500	0.438	0.463	0.588	0.500	0.500	0.593	0.500	0.382	0.500	0.490	0.375	0.500
Extra Trees	0.500	0.542	0.500	0.500	0.500	0.500	0.500	0.500	0.769	0.500	0.579	0.500	0.500	0.500	0.500	0.714	0.500	0.824	0.844	0.500	0.500	0.500	0.500	0.818	0.500	0.500	0.500	0.500	0.500	0.700
Gaussian Naive Bayes	0.944	0.958	0.984	0.887	0.835	0.920	0.955	0.853	0.941	0.897	0.972	0.888	0.849	0.869	0.906	0.871	0.682	0.850	0.876	1.000	0.877	0.838	0.839	0.920	0.785	0.985	0.916	0.837	0.900	0.866
Gradient Boosting	0.871	0.940	0.900	0.952	0.752	0.938	0.977	0.669	0.923	0.796	0.918	0.933	0.800	0.920	0.922	0.828	0.834	0.812	0.921	1.000	0.855	0.772	0.806	0.878	0.868	0.985	0.851	0.881	0.800	0.946
Helstrom Quantum Classifier	0.964	0.898	0.984	0.871	0.835	0.966	0.967	0.891	0.962	0.882	0.944	0.932	0.913	0.886	0.906	0.871	0.812	0.896	0.921	0.980	0.920	0.815	0.858	0.880	0.836	0.956	0.851	0.857	0.900	0.916
Linear Discriminant Analysis	0.889	0.898	0.984	0.919	0.710	0.920	0.932	0.778	0.979	0.859	0.917	0.832	0.828	0.920	0.922	0.849	0.595	0.850	0.876	0.688	0.815	0.857	0.820	0.880	0.500	0.985	0.799	0.857	0.800	0.816
Logistic Regression	0.927	0.938	0.984	0.935	0.835	0.920	0.955	0.778	0.979	0.804	0.944	0.933	0.800	0.841	0.906	0.835	0.747	0.925	0.898	0.958	0.813	0.878	0.858	0.837	0.817	0.985	0.799	0.819	0.800	0.841
Multi Layer Perceptron	0.944	0.918	0.984	0.935	0.752	0.920	0.944	0.835	0.979	0.804	0.944	0.911	0.778	0.841	0.938	0.800	0.812	0.921	0.876	0.958	0.813	0.878	0.774	0.775	0.817	0.971	0.851	0.819	0.900	0.946
Nearest Centroid	0.946	0.940	0.922	0.871	0.878	0.851	0.955	0.819	0.920	0.842	0.863	0.853	0.856	0.817	0.906	0.806	0.790	0.925	0.808	0.898	0.818	0.878	0.846	0.673	0.820	0.985	0.813	0.816	0.953	0.841
Nearest Neighbors	0.944	0.918	1.000	0.785	0.710	0.920	0.911	0.891	1.000	0.827	0.944	0.955	0.814	0.841	0.922	0.828	0.747	0.891	0.865	0.960	0.897	0.813	0.916	0.898	0.852	0.971	0.844	0.822	0.984	0.971
Passive Aggressive Classifier	0.909	0.960	0.984	0.836	0.835	0.938	0.977	0.667	0.979	0.787	0.944	0.833	0.800	0.879	0.706	0.885	0.545	0.853	0.808	0.750	0.708	0.585	0.755	0.878	0.801	0.985	0.734	0.840	0.800	0.816
Perceptron	0.964	0.940	0.800	0.968	0.710	0.938	0.944	0.889	0.979	0.686	0.895	0.888	0.849	0.670	0.922	0.849	0.562	0.950	0.911	0.980	0.688	0.752	0.904	0.940	0.583	0.868	0.663	0.756	0.800	0.950
Quadratic Discriminant Analysis	0.889	0.958	0.984	0.887	0.793	0.938	0.932	0.815	0.941	0.929	0.944	0.888	0.849	0.869	0.891	0.871	0.682	0.850	0.853	1.000	0.918	0.797	0.858	0.920	0.618	1.000	0.871	0.857	0.900	0.866
Random Forest	0.944	0.960	1.000	0.952	0.752	0.938	0.977	0.722	0.979	0.796	0.947	0.933	0.800	0.920	0.984	0.849	0.812	0.950	0.967	1.000	0.833	0.813	0.916	0.877	0.833	0.985	0.799	0.881	0.800	0.950
SVM - linear	0.927	0.960	0.984	0.919	0.835	0.920	0.977	0.778	0.979	0.835	0.972	0.911	0.814	0.920	0.906	0.871	0.725	0.900	0.898	0.958	0.813	0.878	0.858	0.878	0.833	0.985	0.890	0.840	0.900	0.841
SVM - poly	0.927	0.938	0.984	0.884	0.710	0.920	0.977	0.778	0.979	0.851	0.946	0.888	0.828	0.903	0.922	0.835	0.747	0.875	0.944	0.958	0.875	0.837	0.878	0.940	0.801	0.971	0.890	0.881	0.900	0.841
SVM - rbf	0.927	0.960	0.984	0.903	0.835	0.920	0.977	0.853	0.979	0.835	0.972	0.888	0.814	0.903	0.906	0.835	0.747	0.925	0.898	0.958	0.813	0.878	0.858	0.878	0.833	0.985	0.890	0.840	0.900	0.841

Table 4.18 | Balanced accuracy score for 30 homogeneity image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.931	0.970	0.969	0.858	0.653	1.000	0.981	0.920	0.978	0.842	0.855	0.921	0.837	0.878	0.859	0.979	0.946	0.811	0.876	0.955	0.929	0.865	0.897	0.876	0.799	0.938	1.000	0.864	1.000	0.895
Bernoulli Naive Bayes	0.931	0.970	0.952	0.744	0.789	1.000	0.962	0.869	0.935	0.826	0.858	0.871	0.854	0.833	0.897	0.896	0.946	0.810	0.876	0.942	0.957	0.893	0.904	0.757	0.715	0.886	0.918	0.840	0.631	0.816
Dummy Classifier	0.500	0.333	0.500	0.500	0.500	0.500	0.463	0.522	0.500	0.404	0.500	0.500	0.500	0.365	0.371	0.478	0.500	0.500	0.461	0.500	0.346	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.466
Extra Trees	0.500	0.750	0.625	0.500	0.500	0.500	0.818	0.500	0.929	0.500	0.750	0.500	0.500	0.500	0.664	0.731	0.861	0.838	0.900	0.636	0.500	0.864	0.500	0.857	0.500	0.500	0.500	0.500	0.500	0.658
Gaussian Naive Bayes	0.931	0.985	0.969	0.869	0.823	1.000	0.935	0.920	0.978	0.828	0.938	0.921	0.837	0.918	0.835	0.958	0.946	0.810	0.944	0.935	0.929	0.865	0.897	0.757	0.844	0.920	0.897	0.902	1.000	0.868
Gradient Boosting	0.931	0.985	0.844	0.858	0.653	1.000	0.981	0.841	0.978	0.778	0.855	0.921	0.899	0.877	0.679	0.958	0.972	0.811	0.898	0.890	0.907	0.867	0.916	0.876	0.844	0.938	0.958	0.822	0.833	0.895
Helstrom Quantum Classifier	0.931	0.985	1.000	0.834	0.869	1.000	0.962	0.869	0.943	0.891	0.938	0.921	0.878	0.898	0.835	0.979	0.972	0.865	0.865	0.962	0.964	0.867	0.942	0.876	0.871	0.886	0.980	0.881	0.946	0.947
Linear Discriminant Analysis	0.931	0.985	0.969	0.869	0.698	1.000	0.890	0.903	0.957	0.863	0.918	0.921	0.857	0.918	0.827	0.979	0.946	0.838	0.911	0.897	0.929	0.865	0.897	0.757	0.844	0.920	0.917	0.902	1.000	0.895
Logistic Regression	0.931	0.985	0.969	0.903	0.636	1.000	0.890	0.920	0.978	0.842	0.855	0.921	0.881	0.918	0.827	0.958	0.946	0.838	0.888	0.935	0.893	0.865	0.897	0.807	0.753	0.938	0.917	0.864	0.944	0.868
Multi Layer Perceptron	0.931	0.985	0.969	0.823	0.636	1.000	0.916	0.920	0.978	0.863	0.938	0.921	0.861	0.918	0.827	0.941	0.946	0.839	0.888	0.916	0.929	0.893	0.897	0.839	0.871	0.938	0.917	0.840	0.927	0.921
Nearest Centroid	0.931	0.985	0.976	0.851	0.851	1.000	0.942	0.886	0.935	0.877	0.940	0.921	0.875	0.920	0.749	0.958	0.946	0.893	0.898	0.897	0.929	0.867	0.923	0.776	0.878	0.903	0.938	0.840	0.964	0.865
Nearest Neighbors	0.931	0.985	0.969	0.806	0.716	0.964	0.890	0.920	0.964	0.935	0.897	0.971	0.878	0.898	0.686	0.902	0.972	0.920	0.888	0.916	0.893	0.865	0.916	0.876	0.825	0.903	0.813	0.902	0.944	0.947
Passive Aggressive Classifier	0.931	0.985	0.969	0.869	0.653	1.000	0.916	0.920	0.921	0.842	0.918	0.921	0.804	0.878	0.765	0.958	0.946	0.759	0.911	0.916	0.857	0.788	0.864	0.794	0.799	0.858	0.918	0.878	1.000	0.895
Perceptron	0.931	0.985	0.938	0.841	0.608	0.857	0.864	0.841	0.921	0.913	0.918	0.871	0.668	0.897	0.476	0.780	0.889	0.760	0.911	0.935	0.885	0.865	0.897	0.794	0.806	0.983	0.980	0.822	1.000	0.684
Quadratic Discriminant Analysis	0.931	0.985	0.969	0.869	0.823	1.000	0.890	0.903	0.978	0.863	0.855	0.921	0.878	0.918	0.859	0.958	0.946	0.865	0.911	0.935	0.929	0.865	0.916	0.857	0.799	0.920	0.938	0.902	1.000	0.868
Random Forest	0.931	0.985	0.938	0.841	0.653	1.000	0.981	0.920	0.964	0.863	0.855	0.921	0.861	0.938	0.820	1.000	0.946	0.811	0.911	0.935	0.929	0.865	0.897	0.907	0.799	0.938	0.980	0.843	0.889	0.895
SVM - linear	0.931	0.985	0.938	0.903	0.636	0.929	0.890	0.920	0.957	0.842	0.938	0.921	0.878	0.918	0.796	0.979	0.946	0.838	0.888	0.916	0.929	0.893	0.897	0.757	0.753	0.938	0.958	0.864	0.944	0.868
SVM - poly	0.931	0.985	0.938	0.903	0.653	0.964	0.962	0.920	0.943	0.863	0.917	0.971	0.881	0.958	0.796	0.979	0.946	0.865	0.911	0.916	0.929	0.867	0.897	0.857	0.871	0.938	0.813	0.822	0.944	0.842
SVM - rbf	0.931	0.985	0.969	0.903	0.653	0.929	0.890	0.903	0.978	0.842	0.938	0.921	0.881	0.918	0.796	0.979	0.946	0.864	0.888	0.935	0.929	0.865	0.897	0.807	0.753	0.938	0.958	0.902	0.944	0.868

Table 4.19 | AUROC score for 30 RGB image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.863	0.920	0.833	0.731	0.752	0.806	0.793	0.844	0.890	0.693	0.916	0.777	0.721	0.584	0.733	0.979	0.522	0.633	0.875	0.799	0.708	0.868	0.900	0.784	0.700	0.484	0.807	0.813	0.649	0.897
Bernoulli Naive Bayes	0.907	0.772	0.773	0.831	0.636	0.780	0.693	0.916	0.827	0.590	0.935	0.763	0.788	0.709	0.793	0.885	0.707	0.713	0.855	0.755	0.733	0.762	0.855	0.539	0.653	0.722	0.774	0.650	0.724	0.897
Dummy Classifier	0.512	0.500	0.568	0.483	0.500	0.528	0.527	0.463	0.500	0.500	0.509	0.500	0.500	0.453	0.500	0.404	0.447	0.552	0.500	0.500	0.500	0.380	0.500	0.500	0.659	0.569	0.500	0.487	0.577	0.500
Extra Trees	0.643	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.656	0.500	0.682	0.689	0.644	0.500	0.813	0.769	0.593	0.653	0.792	0.545	0.500	0.684	0.500	0.569	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.786	0.806	0.710	0.750	0.626	0.734	0.668	0.851	0.827	0.671	0.844	0.707	0.677	0.716	0.772	0.808	0.662	0.753	0.813	0.657	0.813	0.737	0.933	0.564	0.700	0.553	0.664	0.668	0.667	0.890
Gradient Boosting	0.913	0.869	0.792	0.844	0.790	0.806	0.817	0.818	0.921	0.770	0.871	0.798	0.811	0.761	0.773	1.000	0.812	0.693	0.835	0.851	0.875	0.867	0.933	0.808	0.700	0.484	0.895	0.753	0.722	0.859
Helstrom Quantum Classifier	0.935	0.903	0.877	0.831	0.769	0.760	0.752	0.935	0.890	0.734	0.844	0.822	0.644	0.698	0.797	0.962	0.741	0.797	0.813	0.851	0.708	0.762	0.867	0.756	0.700	0.484	0.769	0.733	0.688	0.914
Linear Discriminant Analysis	0.821	0.903	0.833	0.750	0.643	0.689	0.772	0.773	0.765	0.742	0.844	0.780	0.733	0.653	0.813	0.885	0.644	0.690	0.833	0.799	0.772	0.788	0.900	0.724	0.600	0.484	0.698	0.668	0.667	0.882
Logistic Regression	0.871	0.841	0.813	0.750	0.643	0.760	0.773	0.818	0.921	0.742	0.916	0.801	0.711	0.716	0.813	0.846	0.669	0.753	0.833	0.844	0.752	0.759	0.900	0.699	0.600	0.469	0.698	0.690	0.760	0.938
Multi Layer Perceptron	0.935	0.886	0.855	0.750	0.769	0.760	0.857	0.844	0.890	0.598	0.897	0.798	0.711	0.698	0.878	1.000	0.762	0.775	0.813	0.851	0.813	0.839	0.867	0.731	0.584	0.469	0.824	0.693	0.722	0.882
Nearest Neighbors	0.913	0.795	0.813	0.831	0.769	0.825	0.732	0.935	0.835	0.685	0.955	0.801	0.811	0.698	0.795	0.979	0.703	0.838	0.855	0.851	0.855	0.734	0.877	0.785	0.600	0.484	0.698	0.795	0.651	0.906
Quadratic Discriminant Analysis	0.907	0.851	0.875	0.731	0.643	0.767	0.793	0.871	0.835	0.742	0.890	0.763	0.711	0.636	0.793	0.885	0.746	0.712	0.833	0.844	0.855	0.787	0.911	0.725	0.484	0.569	0.769	0.668	0.760	0.844
Random Forest	0.935	0.886	0.833	0.781	0.824	0.760	0.835	0.825	0.929	0.792	0.890	0.840	0.788	0.709	0.773	1.000	0.791	0.753	0.835	0.897	0.813	0.867	0.933	0.782	0.600	0.484	0.824	0.753	0.593	0.914
SVM - linear	0.821	0.841	0.855	0.750	0.571	0.734	0.793	0.773	0.897	0.742	0.916	0.822	0.677	0.716	0.793	0.846	0.699	0.753	0.813	0.844	0.792	0.842	0.867	0.699	0.600	0.484	0.698	0.648	0.722	0.914
SVM - poly	0.714	0.869	0.708	0.700	0.643	0.708	0.647	0.799	0.866	0.514	0.864	0.819	0.677	0.653	0.732	1.000	0.757	0.818	0.772	0.825	0.792	0.788	0.800	0.810	0.538	0.484	0.840	0.712	0.556	0.938
SVM - rbf	0.893	0.858	0.875	0.650	0.500	0.760	0.813	0.773	0.897	0.756	0.916	0.840	0.677	0.716	0.772	0.923	0.707	0.733	0.813	0.844	0.500	0.842	0.900	0.699	0.600	0.484	0.698	0.648	0.722	0.882

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.20 | AUROC score for 30 L*u*v* image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.793	0.875	0.900	0.781	0.500	0.804	0.849	0.831	0.916	0.787	0.861	0.822	0.627	0.807	0.581	0.861	0.683	0.813	0.836	0.775	0.863	0.851	0.871	0.832	0.600	0.500	0.744	0.735	0.843	0.832
Bernoulli Naive Bayes	0.710	0.830	0.863	0.826	0.769	0.692	0.835	0.826	0.846	0.769	0.902	0.801	0.599	0.803	0.685	0.902	0.655	0.895	0.728	0.753	0.826	0.756	0.946	0.729	0.853	0.735	0.761	0.635	0.881	0.832
Dummy Classifier	0.403	0.614	0.500	0.594	0.471	0.365	0.519	0.500	0.549	0.500	0.442	0.446	0.500	0.518	0.500	0.421	0.599	0.545	0.500	0.510	0.594	0.500	0.542	0.500	0.522	0.500	0.500	0.500	0.532	0.438
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.825	0.500	0.748	0.808	0.500	0.588	0.500	0.808	0.596	0.789	0.645	0.500	0.500	0.749	0.500	0.673	0.500	0.500	0.500	0.500	0.500	0.765
Gaussian Naive Bayes	0.750	0.610	0.881	0.713	0.643	0.577	0.786	0.881	0.821	0.748	0.902	0.784	0.632	0.710	0.563	0.769	0.652	0.868	0.756	0.753	0.844	0.804	0.909	0.671	0.669	0.735	0.841	0.660	0.787	0.828
Gradient Boosting	0.772	0.985	0.931	0.794	0.714	0.846	0.849	0.931	0.916	0.769	0.881	0.822	0.654	0.719	0.735	0.899	0.763	0.867	0.865	0.817	0.863	0.945	0.871	0.776	0.653	0.750	0.869	0.774	0.941	0.837
Helstrom Quantum Classifier	0.855	0.955	0.931	0.681	0.824	0.654	0.778	0.826	0.875	0.731	0.843	0.766	0.632	0.769	0.681	0.920	0.774	0.867	0.700	0.755	0.813	0.882	0.889	0.876	0.738	0.625	0.778	0.685	0.881	0.787
Linear Discriminant Analysis	0.750	0.750	0.800	0.700	0.643	0.538	0.671	0.850	0.775	0.769	0.846	0.748	0.604	0.681	0.568	0.885	0.715	0.813	0.728	0.792	0.863	0.741	0.833	0.673	0.700	0.625	0.761	0.706	0.731	0.824
Logistic Regression	0.750	0.750	0.850	0.813	0.643	0.538	0.778	0.831	0.925	0.769	0.923	0.804	0.604	0.656	0.597	0.885	0.718	0.893	0.757	0.775	0.913	0.772	0.889	0.729	0.700	0.625	0.761	0.685	0.731	0.853
Multi Layer Perceptron	0.855	0.625	0.876	0.813	0.643	0.538	0.814	0.913	0.946	0.769	0.843	0.804	0.605	0.774	0.597	0.885	0.676	0.865	0.757	0.815	0.913	0.827	0.944	0.853	0.700	0.625	0.761	0.660	0.941	0.891
Nearest Neighbors	0.792	0.750	0.950	0.763	0.571	0.748	0.742	0.813	0.896	0.808	0.825	0.745	0.656	0.857	0.656	0.899	0.801	0.917	0.756	0.753	0.881	0.765	0.889	0.832	0.838	0.595	0.761	0.765	0.902	0.857
Quadratic Discriminant Analysis	0.750	0.735	0.831	0.694	0.571	0.577	0.786	0.813	0.821	0.787	0.902	0.861	0.604	0.735	0.538	0.787	0.635	0.867	0.838	0.753	0.863	0.710	0.927	0.694	0.600	0.750	0.726	0.685	0.808	0.857
Random Forest	0.772	0.860	0.950	0.863	0.571	0.808	0.871	0.881	0.916	0.846	0.881	0.822	0.656	0.744	0.681	0.861	0.742	0.867	0.865	0.775	0.863	0.882	0.889	0.821	0.569	0.625	0.806	0.685	0.902	0.807
SVM - linear	0.750	0.625	0.900	0.794	0.500	0.577	0.764	0.850	0.846	0.654	0.902	0.804	0.576	0.681	0.597	0.885	0.718	0.865	0.839	0.753	0.913	0.772	0.833	0.752	0.600	0.625	0.778	0.685	0.846	0.853
SVM - poly	0.835	0.860	0.900	0.763	0.500	0.538	0.750	0.750	0.925	0.654	0.864	0.784	0.605	0.735	0.504	0.846	0.753	0.865	0.784	0.775	0.781	0.882	0.778	0.764	0.700	0.625	0.789	0.618	0.692	0.749
SVM - rbf	0.750	0.500	0.850	0.844	0.571	0.615	0.786	0.850	0.775	0.577	0.881	0.825	0.632	0.681	0.593	0.846	0.697	0.893	0.813	0.753	0.913	0.772	0.778	0.729	0.684	0.500	0.778	0.685	0.808	0.853

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.21 | AUROC score for 30 contrast image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.897	1.000	0.964	0.800	0.841	0.898	0.918	0.831	0.921	0.923	0.921	0.865	0.855	0.814	0.787	0.798	0.826	0.835	0.877	0.944	0.885	0.890	0.769	0.866	0.924	0.807	0.752	0.897	0.800	0.810
Bernoulli Naive Bayes	0.813	0.931	0.927	0.950	0.841	0.875	0.918	0.831	0.857	0.885	0.907	0.697	0.844	0.893	0.757	0.732	0.738	0.780	0.871	0.781	0.921	0.844	0.843	0.844	0.955	0.807	0.752	0.820	0.900	0.725
Dummy Classifier	0.500	0.444	0.542	0.557	0.379	0.500	0.500	0.500	0.431	0.529	0.500	0.484	0.541	0.576	0.500	0.500	0.591	0.579	0.500	0.500	0.534	0.500	0.567	0.472	0.614	0.505	0.500	0.615	0.396	0.500
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.824	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.531	0.500	0.607	0.500	0.500	0.643	0.500	0.765	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.605	1.000	0.833	0.700	0.625	0.833	0.779	0.731	0.857	0.923	0.835	0.808	0.777	0.800	0.719	0.721	0.786	0.704	0.885	0.750	0.885	0.851	0.731	0.789	0.735	0.824	0.688	0.757	0.650	0.808
Gradient Boosting	0.855	1.000	0.964	0.831	0.858	0.940	0.890	0.781	0.921	0.979	0.921	0.972	0.811	0.899	0.866	0.765	0.850	0.835	0.842	0.944	0.885	0.890	0.843	0.827	0.955	0.879	0.752	0.905	0.881	0.782
Helstrom Quantum Classifier	0.752	0.800	0.778	0.750	0.733	0.958	0.807	0.881	0.857	0.885	0.907	0.836	0.877	0.806	0.816	0.765	0.881	0.780	0.877	0.950	0.871	0.874	0.861	0.875	0.970	0.824	0.688	0.851	0.863	0.781
Linear Discriminant Analysis	0.563	0.850	0.833	0.650	0.625	0.792	0.724	0.750	0.857	0.846	0.764	0.722	0.744	0.764	0.660	0.721	0.787	0.704	0.834	0.700	0.764	0.725	0.692	0.820	0.735	0.824	0.647	0.695	0.600	0.806
Logistic Regression	0.730	0.950	0.833	0.650	0.625	0.833	0.918	0.781	0.857	0.941	0.871	0.864	0.777	0.800	0.782	0.765	0.881	0.724	0.899	0.800	0.885	0.890	0.731	0.835	0.735	0.824	0.688	0.820	0.650	0.808
Multi Layer Perceptron	0.835	0.900	0.927	0.800	0.625	0.833	0.890	0.831	0.857	0.885	0.907	0.864	0.777	0.800	0.787	0.765	0.881	0.835	0.877	0.900	0.907	0.826	0.843	0.811	0.955	0.879	0.688	0.851	0.850	0.808
Nearest Neighbors	0.813	0.900	0.833	0.800	0.778	0.938	0.890	0.831	0.857	0.923	0.849	0.836	0.832	0.907	0.871	0.798	0.826	0.835	0.863	0.850	0.835	0.826	0.881	0.882	0.860	0.895	0.730	0.835	0.850	0.782
Quadratic Discriminant Analysis	0.625	1.000	0.889	0.700	0.625	0.833	0.779	0.800	0.857	0.962	0.907	0.808	0.777	0.764	0.719	0.721	0.786	0.760	0.921	0.750	0.885	0.780	0.692	0.851	0.610	0.824	0.688	0.757	0.600	0.781
Random Forest	0.855	0.950	0.964	0.750	0.795	0.920	0.918	0.831	0.857	0.941	0.907	0.946	0.877	0.849	0.841	0.776	0.826	0.835	0.877	0.781	0.885	0.914	0.881	0.890	0.860	0.879	0.752	0.897	0.800	0.782
SVM - linear	0.772	0.900	0.833	0.600	0.608	0.958	0.779	0.781	0.857	0.885	0.871	0.697	0.777	0.835	0.812	0.755	0.857	0.760	0.877	0.750	0.885	0.945	0.710	0.811	0.845	0.824	0.688	0.820	0.650	0.808
SVM - poly	0.730	0.850	0.778	0.650	0.625	0.833	0.724	0.731	0.857	0.885	0.835	0.668	0.777	0.800	0.799	0.721	0.857	0.760	0.899	0.800	0.871	0.866	0.899	0.851	0.625	0.824	0.647	0.780	0.650	0.806
SVM - rbf	0.813	0.500	0.500	0.500	0.500	0.667	0.890	0.500	0.832	0.731	0.871	0.808	0.500	0.835	0.812	0.732	0.857	0.649	0.877	0.500	0.500	0.976	0.615	0.811	0.500	0.500	0.688	0.500	0.700	0.808

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.22 | AUROC score for 30 correlation image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.750	0.844	0.651	0.608	0.760	0.752	0.753	0.769	0.809	0.539	0.500	0.744	0.704	0.753	0.607	0.716	0.557	0.814	0.754	0.734	0.719	0.732	0.837	0.631	0.500	0.669	0.500	0.885	0.817	0.724
Bernoulli Naive Bayes	0.781	0.851	0.655	0.545	0.500	0.500	0.697	0.551	0.688	0.726	0.605	0.644	0.585	0.702	0.525	0.644	0.532	0.570	0.614	0.631	0.601	0.632	0.647	0.661	0.500	0.669	0.520	0.621	0.685	0.803
Dummy Classifier	0.409	0.500	0.500	0.500	0.372	0.500	0.500	0.470	0.500	0.379	0.588	0.541	0.500	0.500	0.528	0.534	0.500	0.526	0.500	0.528	0.403	0.594	0.500	0.500	0.500	0.500	0.427	0.180	0.505	0.406
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.533	0.500	0.500	0.500	0.500	0.500	0.500	0.643	0.500	0.500	0.500	0.500	0.500	0.593	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.681
Gaussian Naive Bayes	0.700	0.753	0.706	0.591	0.643	0.730	0.699	0.618	0.665	0.695	0.587	0.611	0.606	0.753	0.607	0.644	0.532	0.707	0.699	0.820	0.695	0.707	0.752	0.624	0.500	0.669	0.635	0.729	0.702	0.832
Gradient Boosting	0.800	0.864	0.817	0.670	0.767	0.793	0.725	0.952	0.842	0.562	0.815	0.867	0.606	0.646	0.777	0.810	0.732	0.849	0.702	0.897	0.781	0.757	0.815	0.717	0.511	0.753	0.748	0.748	0.750	0.669
Helstrom Quantum Classifier	0.913	0.897	0.839	0.782	0.708	0.712	0.751	0.739	0.786	0.734	0.758	0.844	0.676	0.751	0.717	0.882	0.653	0.699	0.813	0.858	0.765	0.653	0.918	0.701	0.754	0.644	0.828	0.748	0.753	0.757
Linear Discriminant Analysis	0.531	0.773	0.688	0.573	0.572	0.585	0.728	0.618	0.598	0.695	0.545	0.677	0.630	0.702	0.587	0.723	0.507	0.627	0.697	0.878	0.609	0.707	0.690	0.528	0.500	0.653	0.585	0.593	0.602	0.774
Logistic Regression	0.531	0.773	0.706	0.591	0.526	0.585	0.728	0.618	0.598	0.695	0.545	0.644	0.630	0.702	0.587	0.699	0.507	0.627	0.697	0.878	0.609	0.707	0.690	0.528	0.500	0.653	0.585	0.593	0.602	0.744
Multi Layer Perceptron	0.800	0.916	0.690	0.608	0.696	0.797	0.784	0.720	0.898	0.750	0.755	0.833	0.606	0.702	0.778	0.921	0.778	0.790	0.754	0.916	0.726	0.728	0.755	0.780	0.716	0.669	0.856	0.736	0.817	0.774
Nearest Neighbors	0.831	0.780	0.762	0.608	0.696	0.837	0.781	0.820	0.820	0.702	0.777	0.777	0.603	0.728	0.650	0.874	0.619	0.705	0.700	0.897	0.695	0.632	0.898	0.765	0.653	0.638	0.806	0.626	0.702	0.782
Quadratic Discriminant Analysis	0.681	0.753	0.671	0.591	0.643	0.710	0.697	0.602	0.586	0.781	0.630	0.677	0.627	0.702	0.628	0.644	0.532	0.649	0.727	0.878	0.640	0.762	0.753	0.662	0.562	0.669	0.685	0.528	0.618	0.719
Random Forest	0.800	0.734	0.651	0.670	0.806	0.855	0.753	0.968	0.876	0.695	0.815	0.833	0.627	0.727	0.713	0.833	0.753	0.734	0.670	0.897	0.726	0.728	0.898	0.749	0.625	0.669	0.756	0.741	0.801	0.782
SVM - linear	0.500	0.799	0.482	0.608	0.500	0.500	0.728	0.500	0.598	0.500	0.585	0.544	0.500	0.728	0.587	0.708	0.532	0.500	0.727	0.813	0.601	0.707	0.585	0.521	0.500	0.500	0.500	0.547	0.551	0.774
SVM - poly	0.831	0.753	0.633	0.625	0.787	0.837	0.703	0.621	0.853	0.640	0.797	0.677	0.582	0.702	0.607	0.890	0.607	0.713	0.700	0.916	0.734	0.703	0.753	0.679	0.761	0.653	0.699	0.626	0.868	0.656
SVM - rbf	0.500	0.799	0.669	0.500	0.500	0.500	0.782	0.583	0.665	0.656	0.565	0.544	0.500	0.500	0.500	0.500	0.525	0.500	0.500	0.500	0.577	0.707	0.690	0.600	0.500	0.500	0.500	0.500	0.602	0.774

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.23 | AUROC score for 30 energy image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.760	0.940	0.900	0.935	0.752	0.920	0.977	0.667	0.902	0.804	1.000	0.933	0.764	0.920	0.938	0.871	0.834	0.875	0.888	1.000	0.730	0.898	0.916	0.837	0.833	0.985	0.818	0.878	0.800	0.925
Bernoulli Naive Bayes	0.762	0.898	0.953	0.820	0.500	0.828	0.886	0.651	0.846	0.842	0.863	0.820	0.748	0.886	0.591	0.863	0.703	0.825	0.708	0.522	0.692	0.798	0.671	0.900	0.500	0.985	0.710	0.833	0.684	0.841
Dummy Classifier	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.446	0.488	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.590	0.689	0.490	0.500	0.500	0.334	0.466	0.544	0.612
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.654	0.562	0.500	0.500	0.500	0.500	0.500	0.693	0.500	0.500	0.577	0.500	0.500	0.500	0.500	0.797	0.500	0.500	0.500	0.479	0.500	0.500
Gaussian Naive Bayes	0.944	0.958	0.984	0.887	0.835	0.920	0.955	0.853	0.941	0.897	0.972	0.888	0.849	0.869	0.906	0.871	0.682	0.850	0.876	1.000	0.877	0.838	0.839	0.920	0.785	0.985	0.916	0.837	0.900	0.866
Gradient Boosting	0.871	0.940	1.000	0.884	0.752	0.938	0.977	0.669	0.923	0.827	0.918	0.933	0.835	0.920	0.969	0.828	0.812	0.832	0.921	0.980	0.772	0.855	0.851	0.898	0.833	0.985	0.851	0.881	0.800	0.921
Helstrom Quantum Classifier	0.927	0.940	0.984	0.903	0.815	0.862	0.898	0.911	1.000	0.905	0.889	0.921	0.935	0.886	0.891	0.907	0.725	0.925	0.876	0.980	0.920	0.838	0.858	0.880	0.903	0.985	0.806	0.878	0.969	0.946
Linear Discriminant Analysis	0.889	0.898	0.984	0.919	0.688	0.920	0.932	0.778	0.979	0.859	0.917	0.832	0.828	0.920	0.922	0.849	0.595	0.850	0.876	0.688	0.815	0.857	0.820	0.880	0.500	0.985	0.799	0.857	0.800	0.816
Logistic Regression	0.927	0.938	0.984	0.935	0.752	0.920	0.977	0.833	0.979	0.804	0.972	0.933	0.800	0.841	0.906	0.835	0.747	0.925	0.898	0.958	0.813	0.878	0.858	0.837	0.817	0.985	0.799	0.819	0.800	0.841
Multi Layer Perceptron	0.944	0.938	0.984	0.968	0.752	0.920	0.911	0.815	0.979	0.804	0.972	0.933	0.800	0.841	0.906	0.814	0.747	0.946	0.944	0.980	0.813	0.878	0.897	0.857	0.500	0.985	0.844	0.819	0.900	0.921
Nearest Neighbors	0.944	0.918	0.900	0.785	0.793	0.920	0.911	0.927	1.000	0.827	0.944	0.955	0.814	0.841	0.938	0.828	0.747	0.946	0.888	0.960	0.877	0.795	0.832	0.900	0.718	1.000	0.844	0.801	0.984	0.971
Quadratic Discriminant Analysis	0.889	0.958	0.984	0.887	0.793	0.938	0.932	0.815	0.941	0.929	0.944	0.888	0.849	0.869	0.891	0.871	0.682	0.850	0.853	1.000	0.918	0.797	0.858	0.920	0.618	1.000	0.871	0.857	0.900	0.866
Random Forest	0.871	0.960	1.000	0.968	0.752	0.938	0.977	0.833	0.979	0.827	0.947	0.933	0.800	0.920	0.969	0.849	0.790	0.950	0.944	1.000	0.833	0.835	0.916	0.898	0.901	0.985	0.818	0.861	0.800	0.950
SVM - linear	0.927	0.960	0.984	0.935	0.835	0.920	0.955	0.778	0.979	0.835	0.972	0.911	0.863	0.903	0.906	0.835	0.703	0.900	0.898	0.958	0.813	0.858	0.858	0.900	0.833	0.985	0.935	0.857	0.900	0.841
SVM - poly	0.944	0.938	1.000	0.968	0.752	0.920	0.865	0.778	0.885	0.835	0.944	0.888	0.828	0.903	0.922	0.871	0.682	0.875	0.944	0.833	0.835	0.837	0.878	0.900	0.500	0.971	0.825	0.881	0.900	0.841
SVM - rbf	0.927	0.960	0.984	0.903	0.835	0.920	0.977	0.853	0.979	0.835	0.972	0.911	0.828	0.903	0.906	0.835	0.500	0.925	0.898	0.958	0.835	0.858	0.820	0.878	0.833	0.985	0.500	0.500	0.900	0.841

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.24 | AUROC score for 30 homogeneity image feature datasets for cell line U87-MG

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.931	0.985	0.938	0.733	0.653	0.964	0.981	0.920	0.978	0.842	0.855	0.921	0.819	0.918	0.789	0.979	0.946	0.810	0.888	0.935	0.929	0.865	0.897	0.876	0.935	0.938	1.000	0.864	0.944	0.895
Bernoulli Naive Bayes	0.931	0.970	0.952	0.744	0.789	1.000	0.962	0.869	0.935	0.826	0.858	0.871	0.854	0.833	0.897	0.896	0.946	0.810	0.876	0.942	0.957	0.893	0.904	0.757	0.715	0.886	0.918	0.840	0.631	0.816
Dummy Classifier	0.483	0.614	0.609	0.500	0.500	0.500	0.573	0.647	0.453	0.500	0.363	0.500	0.500	0.550	0.545	0.463	0.500	0.500	0.483	0.528	0.500	0.500	0.664	0.459	0.500	0.500	0.500	0.532	0.500	0.522
Extra Trees	0.500	0.500	0.500	0.500	0.500	0.500	0.799	0.500	0.893	0.500	0.708	0.500	0.500	0.667	0.656	0.577	0.918	0.893	0.877	0.500	0.500	0.864	0.500	0.870	0.500	0.500	0.500	0.500	0.500	0.658
Gaussian Naive Bayes	0.931	0.985	0.969	0.869	0.823	1.000	0.935	0.920	0.978	0.828	0.938	0.921	0.837	0.918	0.835	0.958	0.946	0.810	0.944	0.935	0.929	0.865	0.897	0.757	0.844	0.920	0.897	0.902	1.000	0.868
Gradient Boosting	0.931	0.985	0.844	0.858	0.716	1.000	0.935	0.778	0.943	0.863	0.855	0.921	0.692	0.855	0.679	0.938	0.972	0.810	0.898	0.935	0.871	0.841	0.942	0.857	0.760	0.920	1.000	0.801	0.833	0.895
Helstrom Quantum Classifier	0.931	0.985	1.000	0.920	0.869	1.000	0.935	0.903	0.943	0.891	0.898	0.921	0.837	0.898	0.804	0.979	0.946	0.893	0.865	0.962	0.929	0.839	0.962	0.876	0.871	0.903	0.960	0.902	0.946	0.947
Linear Discriminant Analysis	0.931	0.985	0.969	0.869	0.698	1.000	0.890	0.903	0.957	0.863	0.918	0.921	0.857	0.918	0.827	0.979	0.946	0.838	0.911	0.897	0.929	0.865	0.897	0.757	0.844	0.920	0.917	0.902	1.000	0.895
Logistic Regression	0.931	0.985	0.969	0.903	0.653	1.000	0.890	0.920	0.978	0.863	0.938	0.921	0.881	0.918	0.827	0.958	0.946	0.838	0.911	0.935	0.893	0.865	0.897	0.807	0.753	0.938	0.917	0.864	0.944	0.868
Multi Layer Perceptron	0.931	0.985	0.969	0.903	0.636	0.929	0.916	0.920	0.978	0.863	0.938	0.921	0.881	0.898	0.796	0.958	0.972	0.838	0.888	0.935	0.929	0.865	0.916	0.857	0.890	0.938	0.958	0.902	0.944	0.763
Nearest Neighbors	0.931	0.985	0.969	0.823	0.716	0.964	0.890	0.920	0.964	0.935	0.877	0.941	0.878	0.898	0.890	0.902	0.972	0.920	0.888	0.916	0.893	0.865	0.916	0.876	0.844	0.920	0.813	0.902	0.944	0.921
Quadratic Discriminant Analysis	0.931	0.985	0.969	0.869	0.823	1.000	0.890	0.903	0.978	0.863	0.855	0.921	0.878	0.918	0.859	0.958	0.946	0.865	0.911	0.935	0.929	0.865	0.916	0.857	0.799	0.920	0.938	0.902	1.000	0.868
Random Forest	0.931	0.985	0.938	0.858	0.653	1.000	0.981	0.903	0.943	0.863	0.855	0.921	0.878	0.938	0.859	1.000	0.972	0.811	0.911	0.935	0.929	0.865	0.897	0.907	0.799	0.938	0.938	0.864	0.889	0.895
SVM - linear	0.931	0.985	0.938	0.903	0.608	0.929	0.890	0.920	0.957	0.842	0.938	0.921	0.878	0.918	0.796	0.979	0.946	0.838	0.888	0.916	0.929	0.893	0.897	0.757	0.753	0.938	0.875	0.864	0.944	0.868
SVM - poly	0.800	1.000	0.938	0.858	0.545	0.964	0.935	0.920	0.943	0.863	0.938	0.891	0.881	0.708	0.796	0.941	0.946	0.865	0.888	0.916	0.929	0.867	0.871	0.857	0.753	0.875	0.813	0.861	0.722	0.842
SVM - rbf	0.500	1.000	0.500	0.903	0.636	0.500	0.935	0.920	0.500	0.500	0.500	0.921	0.861	0.918	0.796	0.979	0.946	0.864	0.888	0.935	0.500	0.865	0.844	0.757	0.753	0.938	0.500	0.864	0.722	0.868

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.25 | Balanced accuracy score for 30 RGB image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.885	1.000	0.944	0.899	0.920	1.000	0.944	0.938	0.982	0.972	0.957	1.000	0.941	0.940	0.941	0.800	1.000	0.980	1.000	1.000	0.929	1.000	0.884	1.000	0.970	0.971	1.000	0.982	1.000	1.000
Bernoulli Naive Bayes	0.863	1.000	0.944	0.881	0.958	1.000	0.944	0.938	0.964	0.972	0.907	1.000	0.979	1.000	0.941	0.969	0.942	0.980	0.985	1.000	0.929	1.000	0.869	1.000	0.955	0.946	0.977	0.800	0.913	0.984
Dummy Classifier	0.362	0.456	0.472	0.365	0.585	0.500	0.500	0.593	0.500	0.500	0.500	0.500	0.662	0.552	0.500	0.500	0.500	0.508	0.424	0.500	0.531	0.500	0.422	0.500	0.500	0.500	0.500	0.633	0.583	0.500
Extra Trees	0.885	1.000	0.778	0.902	0.923	0.792	0.944	0.938	0.944	0.974	0.929	0.923	0.979	0.958	0.941	0.600	0.955	0.938	1.000	1.000	0.929	0.800	0.500	0.950	0.500	0.912	0.867	0.500	0.781	0.700
Gaussian Naive Bayes	0.863	1.000	0.944	0.902	0.920	1.000	0.944	0.938	0.944	0.972	0.907	0.979	0.979	0.980	0.941	0.900	0.942	0.960	1.000	1.000	0.895	0.950	0.884	1.000	0.985	0.971	0.955	0.835	0.913	0.900
Gradient Boosting	0.885	1.000	0.833	0.958	0.902	0.917	0.944	0.938	0.927	0.944	0.943	0.923	0.979	0.940	0.941	0.700	1.000	0.980	1.000	1.000	1.000	1.000	0.769	1.000	0.720	0.941	1.000	0.927	1.000	1.000
Helstrom Quantum Classifier	0.935	1.000	0.944	0.902	0.902	1.000	0.944	0.938	0.982	0.946	0.964	1.000	0.979	1.000	0.941	0.984	0.962	0.938	1.000	1.000	0.912	0.900	0.884	1.000	0.750	0.971	0.888	0.964	0.981	0.969
Linear Discriminant Analysis	0.921	1.000	0.944	0.920	0.920	0.958	0.889	0.938	1.000	0.944	0.964	1.000	0.979	1.000	0.941	1.000	0.955	0.938	1.000	1.000	0.929	0.900	0.784	0.950	0.970	0.946	0.933	0.889	1.000	0.900
Logistic Regression	0.885	1.000	0.889	0.962	0.923	0.875	0.889	0.938	1.000	0.944	1.000	1.000	0.979	1.000	0.941	0.800	1.000	0.938	1.000	1.000	0.929	1.000	0.884	1.000	0.845	0.946	1.000	0.909	1.000	0.900
Multi Layer Perceptron	0.913	1.000	0.944	0.962	0.881	0.875	0.889	0.938	0.944	0.944	1.000	1.000	0.979	1.000	0.941	0.900	0.955	0.938	1.000	1.000	0.912	1.000	0.784	1.000	0.845	0.946	0.944	0.982	0.950	1.000
Nearest Centroid	0.899	1.000	0.889	0.902	0.881	0.958	0.944	0.855	0.944	0.946	0.907	0.902	0.979	1.000	0.941	1.000	0.909	0.938	1.000	1.000	0.912	0.850	0.784	1.000	0.955	0.916	0.911	0.817	0.863	0.900
Nearest Neighbors	0.935	1.000	1.000	0.979	0.881	0.958	0.982	0.938	0.944	0.974	0.964	1.000	0.902	1.000	0.941	0.784	0.981	0.938	1.000	1.000	0.912	0.950	0.784	1.000	0.985	0.971	0.967	0.982	1.000	0.884
Passive Aggressive Classifier	0.842	0.981	0.889	0.962	0.902	0.875	0.889	0.980	1.000	0.944	0.978	1.000	0.979	0.960	0.979	0.900	0.955	0.918	1.000	1.000	0.929	1.000	0.884	1.000	0.970	0.921	0.977	0.853	0.981	0.900
Perceptron	0.842	1.000	0.944	0.854	0.962	0.813	0.889	0.980	0.944	0.944	0.978	0.962	0.979	0.900	0.941	0.900	0.955	0.918	1.000	1.000	0.929	1.000	0.884	1.000	0.970	0.921	1.000	0.964	0.981	0.800
Quadratic Discriminant Analysis	0.921	1.000	1.000	0.941	0.902	0.958	0.944	0.938	0.982	0.944	0.978	1.000	0.979	0.960	0.941	1.000	0.962	0.960	0.985	1.000	1.000	1.000	0.884	1.000	0.750	0.946	0.955	0.944	0.981	1.000
Random Forest	0.885	1.000	0.889	0.896	0.941	0.917	0.944	0.938	0.982	0.972	0.943	1.000	0.979	0.940	0.941	0.700	1.000	0.980	1.000	1.000	0.929	1.000	0.869	1.000	0.845	0.971	1.000	0.982	1.000	1.000
SVM - linear	0.899	1.000	0.944	0.941	0.941	0.917	1.000	0.980	0.982	0.944	0.978	1.000	0.979	0.980	0.979	0.900	1.000	0.938	1.000	1.000	0.912	1.000	0.784	1.000	0.845	0.975	0.977	0.964	0.981	0.900
SVM - poly	0.863	1.000	0.927	0.902	0.920	0.917	1.000	0.938	1.000	0.918	0.978	1.000	0.979	1.000	0.941	0.800	1.000	0.938	1.000	1.000	0.912	0.900	0.900	1.000	0.860	0.975	0.967	0.927	0.850	0.884
SVM - rbf	0.885	1.000	0.889	0.899	0.941	0.917	0.944	0.938	1.000	0.944	0.978	1.000	0.979	0.980	0.979	0.900	1.000	0.938	1.000	1.000	0.929	1.000	0.784	1.000	0.845	0.975	0.977	0.982	1.000	0.900

Table 4.26 | Balanced accuracy score for 30 L*u*v* image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.885	1.000	0.944	0.896	0.979	0.917	0.944	0.938	0.982	0.972	0.943	1.000	0.941	0.940	0.941	0.700	0.962	0.960	1.000	1.000	0.929	1.000	0.884	1.000	0.720	0.946	0.977	0.944	0.981	0.969
Bernoulli Naive Bayes	0.935	1.000	1.000	0.861	0.938	0.980	0.982	0.980	0.964	0.944	0.921	1.000	0.979	0.940	0.979	0.969	0.942	0.940	0.970	1.000	0.967	1.000	0.969	0.981	0.924	0.975	0.955	0.982	0.981	0.953
Dummy Classifier	0.500	0.500	0.500	0.522	0.484	0.443	0.435	0.500	0.562	0.500	0.475	0.500	0.500	0.467	0.502	0.606	0.500	0.500	0.500	0.500	0.500	0.539	0.500	0.639	0.500	0.500	0.518	0.500	0.500	0.575
Extra Trees	0.885	1.000	0.944	0.899	0.979	0.958	0.944	0.938	0.944	0.946	0.943	1.000	0.979	1.000	0.941	0.700	0.981	0.918	1.000	1.000	0.929	0.850	0.500	1.000	0.500	0.971	0.977	0.927	0.981	0.900
Gaussian Naive Bayes	0.899	1.000	1.000	0.861	0.979	1.000	1.000	0.938	0.982	0.944	0.943	1.000	0.979	0.940	0.979	1.000	0.942	0.940	0.985	1.000	0.983	1.000	0.984	1.000	0.985	0.946	0.955	0.927	0.981	0.984
Gradient Boosting	0.863	1.000	0.944	0.920	0.923	0.958	0.889	0.855	0.889	0.972	0.929	0.962	0.979	0.898	0.979	0.900	1.000	0.898	1.000	1.000	0.929	1.000	0.869	1.000	0.720	0.946	0.977	0.982	1.000	1.000
Helstrom Quantum Classifier	0.913	1.000	1.000	0.938	0.941	0.958	0.982	0.938	0.982	0.918	1.000	1.000	0.958	0.960	0.941	0.984	0.981	0.940	0.985	1.000	0.967	1.000	0.984	1.000	0.875	0.946	0.911	0.982	1.000	0.969
Linear Discriminant Analysis	0.921	1.000	0.944	0.920	0.979	1.000	0.889	0.938	1.000	0.944	1.000	1.000	0.979	0.960	0.941	1.000	1.000	0.960	1.000	1.000	0.929	1.000	0.784	1.000	0.970	0.946	1.000	0.944	0.981	0.900
Logistic Regression	0.885	1.000	0.833	0.941	0.941	0.917	0.889	0.938	1.000	0.918	1.000	1.000	0.979	0.960	0.979	1.000	1.000	0.898	1.000	1.000	0.929	1.000	0.784	1.000	0.860	0.946	1.000	0.853	1.000	1.000
Multi Layer Perceptron	0.899	1.000	1.000	0.941	0.941	0.958	1.000	0.980	0.982	0.918	1.000	1.000	0.979	0.960	0.979	0.900	1.000	0.940	0.985	1.000	0.929	1.000	0.984	1.000	0.860	0.975	1.000	0.853	0.981	1.000
Nearest Centroid	0.935	1.000	0.944	0.899	0.938	1.000	1.000	0.938	0.982	0.918	0.943	1.000	0.979	0.940	0.979	0.984	0.962	0.940	0.985	1.000	0.895	1.000	0.984	1.000	0.955	0.946	0.977	0.927	0.981	1.000
Nearest Neighbors	0.957	1.000	1.000	0.878	0.843	0.917	1.000	0.980	0.927	0.918	1.000	1.000	0.979	0.938	0.941	0.884	0.981	0.918	0.985	1.000	0.929	1.000	0.800	1.000	0.750	0.946	1.000	0.944	1.000	1.000
Passive Aggressive Classifier	0.863	1.000	0.833	0.920	0.885	0.875	0.889	0.855	0.944	0.944	1.000	1.000	0.979	0.940	0.979	0.900	0.962	0.918	1.000	1.000	0.929	1.000	0.884	1.000	0.985	0.946	1.000	0.927	0.950	0.984
Perceptron	0.835	1.000	0.778	0.962	0.923	0.875	0.889	0.980	0.944	0.918	1.000	0.885	0.979	0.960	0.941	0.800	1.000	0.878	1.000	1.000	0.929	1.000	0.584	1.000	0.750	0.975	0.967	0.964	0.981	1.000
Quadratic Discriminant Analysis	0.885	1.000	1.000	0.941	0.902	0.958	0.944	0.938	0.964	0.944	1.000	1.000	0.979	0.960	0.941	0.900	0.981	0.918	0.985	1.000	0.929	1.000	0.884	1.000	1.000	0.946	0.955	1.000	0.981	0.984
Random Forest	0.885	1.000	0.944	0.917	0.979	0.958	0.889	0.938	0.982	0.944	0.907	1.000	0.979	0.940	0.941	0.800	0.962	0.940	1.000	1.000	0.929	1.000	0.984	1.000	0.985	0.946	0.977	1.000	0.981	0.984
SVM - linear	0.921	1.000	1.000	0.920	0.941	0.958	0.889	0.980	1.000	0.918	1.000	0.962	0.979	0.940	0.979	1.000	1.000	0.898	0.985	1.000	0.929	1.000	0.784	1.000	0.845	0.946	1.000	0.927	1.000	0.984
SVM - poly	0.885	1.000	1.000	0.941	0.941	0.958	0.889	0.980	0.982	0.918	1.000	1.000	0.979	0.960	0.941	0.800	1.000	0.918	0.985	1.000	0.929	1.000	0.784	1.000	0.860	0.946	1.000	0.871	1.000	1.000
SVM - rbf	0.921	1.000	1.000	0.920	0.941	1.000	0.944	0.938	0.982	0.944	1.000	0.962	0.979	0.960	0.979	1.000	1.000	0.940	1.000	1.000	0.929	1.000	0.784	1.000	0.860	0.975	1.000	0.927	1.000	0.984

Table 4.27 | Balanced accuracy score for 30 contrast image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.870	0.981	0.964	0.753	0.700	0.897	0.911	0.920	0.800	0.861	0.711	0.917	0.854	0.858	0.721	0.769	0.839	0.677	0.830	0.920	0.883	0.944	0.669	0.926	0.500	0.715	0.820	0.800	0.894	0.891
Bernoulli Naive Bayes	0.762	0.890	0.964	0.686	0.739	0.835	0.853	0.855	0.722	0.706	0.699	0.745	0.665	0.650	0.591	0.569	0.741	0.423	0.720	0.614	0.560	0.844	0.500	0.813	0.500	0.715	0.786	0.744	0.807	0.822
Dummy Classifier	0.500	0.500	0.562	0.345	0.500	0.500	0.526	0.500	0.506	0.491	0.584	0.500	0.421	0.487	0.500	0.500	0.500	0.500	0.500	0.500	0.481	0.500	0.538	0.370	0.485	0.434	0.500	0.579	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.704	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.778	0.799	0.760	0.668	0.627	0.625	0.760	0.750	0.611	0.632	0.542	0.612	0.591	0.565	0.686	0.500	0.598	0.503	0.735	0.532	0.417	0.750	0.584	0.631	0.610	0.538	0.776	0.722	0.631	0.684
Gradient Boosting	0.848	0.981	0.964	0.697	0.718	0.855	0.855	0.877	0.744	0.813	0.776	0.840	0.798	0.733	0.899	0.853	0.923	0.528	0.955	0.863	0.862	0.844	0.669	0.857	0.595	0.921	0.764	0.724	0.844	0.822
Helstrom Quantum Classifier	0.848	0.981	0.891	0.694	0.603	0.835	0.837	0.918	0.780	0.759	0.891	0.822	0.780	0.757	0.801	0.759	0.839	0.427	0.845	0.810	0.767	0.739	0.622	0.763	0.970	0.862	0.853	0.762	0.907	0.828
Linear Discriminant Analysis	0.756	0.708	0.631	0.707	0.588	0.627	0.760	0.792	0.611	0.550	0.562	0.612	0.591	0.565	0.532	0.500	0.500	0.442	0.735	0.531	0.510	0.750	0.584	0.650	0.610	0.538	0.776	0.760	0.731	0.569
Logistic Regression	0.756	0.818	0.687	0.686	0.683	0.668	0.760	0.833	0.667	0.602	0.699	0.612	0.609	0.565	0.532	0.500	0.500	0.462	0.735	0.531	0.510	0.731	0.484	0.631	0.485	0.568	0.776	0.760	0.713	0.569
Multi Layer Perceptron	0.762	0.890	0.927	0.638	0.620	0.855	0.946	0.833	0.889	0.784	0.719	0.728	0.780	0.733	0.822	0.553	0.897	0.548	0.720	0.836	0.740	0.744	0.584	0.713	0.610	0.744	0.720	0.817	0.857	0.806
Nearest Centroid	0.820	0.839	0.891	0.837	0.736	0.960	0.817	0.735	0.837	0.781	0.648	0.662	0.700	0.713	0.756	0.597	0.858	0.510	0.970	0.487	0.674	0.683	0.822	0.844	0.955	0.803	0.753	0.708	0.839	0.875
Nearest Neighbors	0.842	0.916	0.871	0.795	0.659	0.793	0.837	0.918	0.798	0.703	0.812	0.724	0.728	0.673	0.647	0.769	0.962	0.550	0.720	0.863	0.740	0.831	0.553	0.581	0.625	0.832	0.786	0.762	0.944	0.822
Passive Aggressive Classifier	0.734	0.818	0.909	0.647	0.774	0.675	0.817	0.837	0.800	0.579	0.683	0.500	0.712	0.563	0.593	0.600	0.624	0.480	0.860	0.436	0.674	0.776	0.584	0.713	0.799	0.656	0.842	0.780	0.683	0.544
Perceptron	0.734	0.773	0.798	0.513	0.662	0.710	0.817	0.918	0.611	0.538	0.604	0.476	0.309	0.512	0.434	0.600	0.491	0.403	0.485	0.518	0.631	0.813	0.822	0.763	0.985	0.685	0.853	0.744	0.489	0.875
Quadratic Discriminant Analysis	0.814	0.818	0.815	0.707	0.627	0.667	0.704	0.708	0.611	0.548	0.534	0.591	0.591	0.607	0.571	0.500	0.624	0.462	0.735	0.560	0.488	0.731	0.584	0.650	0.610	0.538	0.776	0.704	0.681	0.584
Random Forest	0.820	1.000	0.964	0.753	0.739	0.897	0.946	0.938	0.780	0.756	0.784	0.899	0.875	0.817	0.801	0.653	0.858	0.672	0.970	0.918	0.812	0.863	0.600	0.826	0.500	0.799	0.786	0.706	0.931	0.822
SVM - linear	0.770	0.890	0.853	0.686	0.721	0.710	0.853	0.897	0.667	0.550	0.699	0.630	0.665	0.565	0.434	0.500	0.500	0.462	0.860	0.529	0.433	0.650	0.500	0.631	0.500	0.597	0.786	0.780	0.713	0.600
SVM - poly	0.727	0.864	0.964	0.732	0.638	0.980	0.911	0.878	0.649	0.759	0.705	0.787	0.774	0.753	0.784	0.669	0.878	0.612	0.720	0.838	0.829	0.776	0.553	0.694	0.500	0.744	0.753	0.762	0.826	0.806
SVM - rbf	0.699	0.890	0.964	0.784	0.718	0.793	0.853	0.877	0.667	0.654	0.720	0.686	0.665	0.607	0.490	0.500	0.533	0.462	0.860	0.557	0.505	0.650	0.500	0.631	0.500	0.626	0.786	0.762	0.713	0.769

Table 4.28 | Balanced accuracy score for 30 correlation image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.610	0.708	0.800	0.593	0.718	0.625	0.690	0.857	0.728	0.750	0.761	0.780	0.795	0.733	0.676	0.469	0.734	0.670	0.784	0.699	0.762	0.650	0.469	0.844	0.500	0.765	0.786	0.722	0.713	0.591
Bernoulli Naive Bayes	0.661	0.572	0.633	0.596	0.676	0.667	0.673	0.878	0.671	0.779	0.756	0.612	0.798	0.757	0.683	0.500	0.657	0.592	0.549	0.754	0.740	0.757	0.500	0.752	0.500	0.631	0.830	0.633	0.402	0.622
Dummy Classifier	0.500	0.500	0.500	0.484	0.383	0.500	0.415	0.500	0.500	0.500	0.500	0.490	0.500	0.500	0.500	0.500	0.500	0.467	0.394	0.500	0.500	0.557	0.344	0.470	0.470	0.500	0.500	0.500	0.500	0.544
Extra Trees	0.500	0.500	0.500	0.596	0.651	0.500	0.500	0.730	0.500	0.500	0.564	0.500	0.707	0.500	0.500	0.500	0.500	0.500	0.500	0.528	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.669	0.806	0.780	0.596	0.736	0.750	0.653	0.918	0.706	0.702	0.762	0.651	0.819	0.755	0.623	0.500	0.832	0.652	0.705	0.725	0.812	0.813	0.684	0.844	0.625	0.656	0.686	0.780	0.576	0.622
Gradient Boosting	0.691	0.722	0.744	0.582	0.721	0.708	0.690	0.858	0.724	0.756	0.812	0.742	0.662	0.733	0.550	0.569	0.760	0.668	0.814	0.890	0.631	0.750	0.669	0.807	0.625	0.681	0.765	0.651	0.726	0.491
Helstrom Quantum Classifier	0.755	0.839	0.873	0.635	0.715	0.855	0.710	0.898	0.837	0.705	0.719	0.760	0.837	0.777	0.659	0.791	0.698	0.652	0.784	0.836	0.883	0.839	0.806	0.826	0.909	0.706	0.686	0.873	0.765	0.628
Linear Discriminant Analysis	0.612	0.670	0.780	0.596	0.676	0.688	0.671	0.877	0.706	0.677	0.719	0.651	0.819	0.795	0.567	0.600	0.832	0.547	0.595	0.697	0.812	0.781	0.569	0.794	0.500	0.543	0.653	0.817	0.676	0.622
Logistic Regression	0.598	0.670	0.780	0.596	0.676	0.688	0.688	0.877	0.651	0.677	0.683	0.651	0.819	0.773	0.567	0.600	0.832	0.567	0.595	0.670	0.669	0.781	0.584	0.794	0.500	0.543	0.653	0.835	0.594	0.622
Multi Layer Perceptron	0.727	0.767	0.873	0.561	0.676	0.708	0.746	0.775	0.726	0.677	0.748	0.878	0.742	0.773	0.606	0.706	0.691	0.547	0.830	0.810	0.740	0.626	0.784	0.844	0.610	0.660	0.698	0.762	0.726	0.522
Nearest Centroid	0.654	0.832	0.819	0.596	0.676	0.813	0.673	0.918	0.764	0.700	0.711	0.683	0.816	0.735	0.599	0.791	0.774	0.633	0.614	0.727	0.795	0.857	0.822	0.826	0.803	0.610	0.786	0.911	0.659	0.575
Nearest Neighbors	0.798	0.794	0.744	0.593	0.697	0.855	0.599	0.795	0.855	0.624	0.755	0.857	0.704	0.797	0.721	0.738	0.767	0.753	0.830	0.807	0.631	0.794	0.784	0.844	0.750	0.765	0.653	0.835	0.807	0.822
Passive Aggressive Classifier	0.492	0.827	0.714	0.593	0.479	0.542	0.510	0.612	0.161	0.621	0.624	0.822	0.753	0.757	0.508	0.500	0.767	0.612	0.549	0.567	0.414	0.563	0.791	0.626	0.500	0.551	0.786	0.802	0.789	0.644
Perceptron	0.548	0.365	0.429	0.596	0.490	0.813	0.728	0.898	0.688	0.598	0.620	0.497	0.641	0.838	0.495	0.428	0.722	0.570	0.739	0.500	0.571	0.850	0.569	0.826	0.500	0.665	0.698	0.911	0.500	0.606
Quadratic Discriminant Analysis	0.705	0.760	0.891	0.575	0.736	0.708	0.597	0.918	0.706	0.730	0.711	0.710	0.857	0.775	0.665	0.500	0.624	0.547	0.580	0.697	0.740	0.831	0.784	0.826	0.625	0.685	0.653	0.927	0.720	0.506
Random Forest	0.727	0.741	0.835	0.579	0.777	0.792	0.708	0.918	0.762	0.784	0.899	0.787	0.724	0.670	0.668	0.584	0.780	0.670	0.830	0.835	0.790	0.800	0.684	0.794	0.500	0.647	0.676	0.760	0.881	0.606
SVM - linear	0.683	0.689	0.835	0.575	0.676	0.688	0.635	0.857	0.726	0.702	0.769	0.689	0.798	0.755	0.606	0.500	0.832	0.610	0.580	0.725	0.829	0.831	0.500	0.844	0.500	0.601	0.686	0.853	0.676	0.622
SVM - poly	0.798	0.825	0.835	0.673	0.679	0.750	0.635	0.858	0.744	0.784	0.784	0.760	0.742	0.777	0.756	0.606	0.787	0.610	0.705	0.810	0.762	0.763	0.538	0.826	0.595	0.710	0.630	0.798	0.670	0.691
SVM - rbf	0.683	0.689	0.891	0.596	0.715	0.688	0.635	0.877	0.671	0.702	0.769	0.651	0.798	0.755	0.623	0.500	0.832	0.630	0.564	0.725	0.829	0.781	0.500	0.794	0.500	0.601	0.653	0.853	0.776	0.622

Table 4.29 | Balanced accuracy score for 30 energy image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.812	1.000	0.964	0.774	0.756	0.897	0.835	0.980	0.964	0.806	0.699	0.822	0.875	0.878	0.837	0.669	0.878	0.778	0.970	0.944	0.829	1.000	0.669	0.863	0.500	0.921	0.898	0.946	0.876	0.875
Bernoulli Naive Bayes	0.783	0.677	0.837	0.771	0.792	0.690	0.839	0.920	0.837	0.807	0.856	0.630	0.683	0.860	0.816	0.500	0.865	0.695	0.500	0.868	0.779	0.500	0.500	0.652	0.500	0.626	0.864	0.575	0.565	0.753
Dummy Classifier	0.576	0.500	0.500	0.516	0.421	0.507	0.433	0.500	0.500	0.500	0.500	0.410	0.500	0.500	0.500	0.500	0.500	0.383	0.500	0.500	0.426	0.557	0.575	0.500	0.500	0.404	0.500	0.653	0.602	0.522
Extra Trees	0.500	0.500	0.500	0.763	0.538	0.500	0.500	0.855	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.545	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.798	1.000	0.964	0.795	0.833	0.917	0.835	0.980	0.982	0.806	0.790	0.938	0.899	0.878	0.833	0.853	0.878	0.778	0.955	0.946	0.900	1.000	0.953	0.913	0.750	0.866	0.876	0.929	0.876	0.844
Gradient Boosting	0.742	1.000	0.964	0.777	0.816	0.855	0.835	0.980	0.817	0.892	0.699	0.861	0.742	0.837	0.795	0.769	0.787	0.737	0.955	0.944	0.829	1.000	0.953	0.844	0.595	0.832	0.898	0.891	0.863	0.806
Helstrom Quantum Classifier	0.848	0.942	0.946	0.792	0.736	0.875	0.929	0.980	0.893	0.811	0.870	0.917	0.798	0.838	0.837	0.853	0.923	0.800	0.909	0.920	0.867	0.907	0.838	0.907	0.985	0.925	0.876	0.817	0.907	0.797
Linear Discriminant Analysis	0.870	0.825	0.964	0.712	0.812	0.772	0.929	0.940	0.964	0.702	0.812	0.615	0.837	0.900	0.840	0.600	0.904	0.673	0.485	0.920	0.795	0.800	0.500	0.600	0.500	0.744	0.865	0.780	0.881	0.900
Logistic Regression	0.798	1.000	0.964	0.774	0.795	0.897	0.946	0.980	0.982	0.810	0.784	0.822	0.875	0.878	0.854	0.884	0.878	0.778	0.830	0.946	0.795	1.000	0.869	0.963	0.500	0.862	0.876	0.946	0.863	0.838
Multi Layer Perceptron	0.798	1.000	0.964	0.795	0.812	0.813	0.946	0.980	0.964	0.811	0.820	0.899	0.896	0.878	0.724	0.753	0.923	0.820	0.970	0.946	0.812	1.000	0.784	0.944	0.625	0.862	0.876	0.780	0.863	0.938
Nearest Centroid	0.804	0.885	0.911	0.712	0.812	0.920	0.893	0.920	0.893	0.725	0.870	0.641	0.774	0.900	0.833	0.922	0.904	0.800	0.864	0.839	0.850	0.926	0.906	0.889	0.879	0.900	0.830	0.837	0.889	0.797
Nearest Neighbors	0.877	0.962	0.964	0.816	0.875	0.833	0.893	0.960	0.780	0.756	0.848	0.822	0.837	0.797	0.665	0.869	0.942	0.755	0.939	0.946	0.883	0.881	0.900	0.876	0.750	0.916	0.865	0.762	0.963	0.906
Passive Aggressive Classifier	0.784	0.818	0.964	0.774	0.739	0.897	0.631	0.940	0.502	0.730	0.798	0.710	0.896	0.878	0.854	0.684	0.878	0.485	0.955	0.920	0.757	1.000	0.500	0.681	0.485	0.866	0.876	0.855	0.907	0.844
Perceptron	0.870	1.000	0.611	0.627	0.553	0.813	0.853	0.563	0.929	0.575	0.776	0.843	0.837	0.878	0.665	0.784	0.878	0.732	0.939	0.722	0.867	0.900	0.884	0.713	0.625	0.715	0.876	0.667	0.844	0.691
Quadratic Discriminant Analysis	0.798	1.000	0.964	0.795	0.833	0.958	0.835	0.980	0.964	0.806	0.755	0.938	0.840	0.878	0.833	0.853	0.878	0.798	0.830	0.946	0.900	1.000	1.000	0.913	0.750	0.891	0.898	0.929	0.894	0.844
Random Forest	0.770	1.000	0.964	0.795	0.756	0.897	0.853	0.980	0.798	0.890	0.792	0.861	0.917	0.878	0.857	0.569	0.878	0.715	0.970	0.944	0.900	0.950	0.700	0.863	0.500	0.891	0.898	0.909	0.900	0.922
SVM - linear	0.834	1.000	0.964	0.753	0.812	0.980	0.946	0.960	0.964	0.833	0.826	0.938	0.875	0.858	0.833	0.784	0.878	0.778	0.955	0.946	0.900	1.000	0.584	0.944	0.500	0.896	0.876	0.911	0.876	0.844
SVM - poly	0.848	1.000	0.964	0.792	0.736	0.897	0.835	0.940	0.911	0.811	0.870	0.857	0.854	0.838	0.833	0.853	0.923	0.757	0.814	0.946	0.883	1.000	0.800	0.944	0.610	0.832	0.876	0.873	0.863	0.891
SVM - rbf	0.834	1.000	0.964	0.753	0.812	0.980	0.946	0.960	0.964	0.833	0.790	0.938	0.875	0.858	0.833	0.784	0.878	0.778	0.955	0.946	0.900	1.000	0.584	0.944	0.500	0.925	0.909	0.929	0.826	0.844

Table 4.30 | Balanced accuracy score for 30 homogeneity image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.848	0.981	0.964	0.774	0.812	0.855	0.891	0.980	0.891	0.917	0.776	0.938	0.875	0.838	0.854	0.869	0.878	0.758	0.830	0.890	0.883	0.981	0.969	0.963	0.500	0.891	0.909	0.911	0.900	0.938
Bernoulli Naive Bayes	0.848	0.981	0.964	0.792	0.812	0.817	0.929	0.980	0.946	0.778	0.806	0.766	0.857	0.838	0.854	0.638	0.885	0.758	0.769	0.946	0.900	0.844	0.500	0.944	0.500	0.950	0.886	0.911	0.870	0.838
Dummy Classifier	0.497	0.593	0.500	0.457	0.500	0.565	0.500	0.500	0.500	0.500	0.554	0.500	0.500	0.500	0.362	0.500	0.470	0.500	0.500	0.500	0.500	0.476	0.500	0.420	0.424	0.497	0.500	0.500	0.402	0.500
Extra Trees	0.571	0.500	0.500	0.777	0.707	0.500	0.760	0.897	0.500	0.553	0.585	0.500	0.595	0.625	0.630	0.500	0.935	0.500	0.500	0.751	0.648	0.500	0.500	0.500	0.500	0.500	0.521	0.500	0.500	0.500
Gaussian Naive Bayes	0.820	1.000	0.964	0.774	0.837	0.938	0.891	0.938	0.982	0.890	0.669	0.899	0.878	0.878	0.875	0.869	0.897	0.695	0.970	0.918	0.829	0.981	0.869	0.963	0.750	0.916	0.898	0.873	0.894	0.891
Gradient Boosting	0.820	1.000	0.964	0.795	0.854	0.980	0.891	0.980	0.946	0.944	0.727	0.784	0.801	0.838	0.816	0.669	0.923	0.758	0.970	0.835	0.740	0.981	0.900	0.913	0.500	0.921	0.932	0.946	0.894	0.953
Helstrom Quantum Classifier	0.848	0.981	0.964	0.753	0.756	0.897	0.946	0.897	0.871	0.890	0.790	0.938	0.857	0.838	0.875	0.938	0.878	0.758	0.955	0.890	0.900	0.981	0.953	0.963	0.970	0.950	0.932	0.873	0.863	0.859
Linear Discriminant Analysis	0.812	0.981	0.964	0.774	0.854	0.960	0.946	0.980	0.964	0.835	0.669	0.938	0.878	0.838	0.798	0.784	0.897	0.695	0.970	0.890	0.900	0.981	0.869	0.963	0.610	0.921	0.932	0.817	0.913	0.891
Logistic Regression	0.820	1.000	1.000	0.774	0.875	0.897	0.946	0.897	0.909	0.920	0.691	0.822	0.878	0.837	0.798	0.684	0.897	0.673	0.970	0.890	0.845	1.000	0.869	0.913	0.610	0.774	0.898	0.835	0.863	0.906
Multi Layer Perceptron	0.820	1.000	0.964	0.774	0.795	0.897	0.946	0.980	0.798	0.759	0.762	0.938	0.780	0.838	0.780	0.769	0.878	0.695	0.970	0.918	0.900	1.000	0.700	0.963	0.500	0.862	0.932	0.873	0.931	0.953
Nearest Centroid	0.870	0.923	0.964	0.753	0.812	0.960	0.946	0.980	0.946	0.806	0.790	0.899	0.875	0.838	0.854	0.953	0.885	0.758	0.939	0.811	0.900	0.981	0.922	0.963	0.909	0.921	0.886	0.911	0.876	0.859
Nearest Neighbors	0.842	0.981	0.909	0.753	0.812	0.855	0.946	0.980	0.891	0.730	0.820	0.920	0.763	0.858	0.724	0.669	0.858	0.717	0.970	0.946	0.900	0.931	0.700	0.963	0.625	0.950	0.898	0.817	0.963	0.938
Passive Aggressive Classifier	0.756	0.981	0.946	0.627	0.854	0.960	0.631	0.897	0.982	0.806	0.761	0.538	0.784	0.773	0.553	0.769	0.890	0.632	0.735	0.500	0.569	1.000	0.869	0.963	0.500	0.563	0.832	0.780	0.731	0.906
Perceptron	0.792	1.000	1.000	0.571	0.700	0.793	0.909	0.938	0.815	0.656	0.649	0.822	0.878	0.818	0.603	0.869	0.851	0.400	0.735	0.694	0.757	1.000	0.684	0.963	0.500	0.891	0.932	0.835	0.876	0.922
Quadratic Discriminant Analysis	0.856	1.000	0.964	0.736	0.875	0.938	0.891	0.938	0.964	0.918	0.669	0.938	0.840	0.878	0.837	0.869	0.878	0.735	0.970	0.890	0.900	0.981	0.800	0.963	0.625	0.891	0.898	0.817	0.913	0.791
Random Forest	0.877	1.000	0.964	0.774	0.857	0.813	0.909	0.980	0.853	0.839	0.770	0.861	0.801	0.838	0.896	0.769	0.878	0.715	0.970	0.944	0.883	0.981	0.600	0.963	0.500	0.862	0.898	0.946	0.900	0.953
SVM - linear	0.870	0.981	0.964	0.771	0.854	0.960	0.946	0.980	0.964	0.835	0.776	0.938	0.878	0.838	0.854	0.684	0.878	0.695	0.970	0.918	0.900	1.000	0.769	0.963	0.500	0.950	0.932	0.817	0.913	0.906
SVM - poly	0.870	1.000	0.964	0.771	0.837	0.980	0.946	0.980	0.780	0.839	0.762	0.938	0.917	0.838	0.854	0.969	0.878	0.695	0.970	0.946	0.900	1.000	0.584	0.963	0.625	0.862	0.898	0.817	0.913	0.922
SVM - rbf	0.848	1.000	0.964	0.812	0.854	0.960	0.946	0.980	0.964	0.917	0.705	0.938	0.878	0.838	0.854	0.784	0.878	0.737	0.970	0.918	0.900	0.981	0.769	0.963	0.500	0.832	0.932	0.873	0.913	0.906

Table 4.31 | AUROC score for 30 RGB image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.921	1.000	0.944	0.920	0.941	1.000	0.944	0.938	0.982	0.972	0.957	0.962	0.979	0.940	0.941	0.700	1.000	0.980	1.000	1.000	0.929	1.000	0.784	1.000	0.720	0.971	0.977	0.927	1.000	1.000
Bernoulli Naive Bayes	0.863	1.000	0.944	0.881	0.958	1.000	0.944	0.938	0.964	0.972	0.907	1.000	0.979	1.000	0.941	0.969	0.942	0.980	0.985	1.000	0.929	1.000	0.869	1.000	0.955	0.946	0.977	0.800	0.913	0.984
Dummy Classifier	0.500	0.399	0.500	0.502	0.463	0.505	0.500	0.365	0.397	0.500	0.500	0.500	0.500	0.500	0.481	0.297	0.444	0.590	0.500	0.428	0.602	0.439	0.500	0.500	0.500	0.572	0.339	0.431	0.500	0.500
Extra Trees	0.679	1.000	0.833	0.902	0.923	0.833	0.889	0.938	0.944	0.946	0.929	0.923	0.979	0.958	0.941	0.600	0.955	0.938	1.000	1.000	0.929	0.850	0.500	0.950	0.500	0.912	0.944	0.556	0.731	0.700
Gaussian Naive Bayes	0.863	1.000	0.944	0.902	0.920	1.000	0.944	0.938	0.944	0.972	0.907	0.979	0.979	0.980	0.941	0.900	0.942	0.960	1.000	1.000	0.895	0.950	0.884	1.000	0.985	0.971	0.955	0.835	0.913	0.900
Gradient Boosting	0.921	1.000	0.833	0.878	0.902	0.875	0.944	0.855	0.927	0.944	0.943	0.962	0.979	0.940	0.941	0.700	1.000	0.500	1.000	1.000	1.000	1.000	0.769	1.000	0.720	0.941	1.000	0.871	1.000	1.000
Helstrom Quantum Classifier	0.957	1.000	0.944	0.920	0.899	1.000	0.944	0.980	1.000	0.946	0.964	1.000	0.941	1.000	0.941	0.969	0.981	0.938	1.000	1.000	0.912	1.000	0.900	1.000	0.939	0.946	0.888	0.944	1.000	0.800
Linear Discriminant Analysis	0.921	1.000	0.944	0.920	0.920	0.958	0.889	0.938	1.000	0.944	0.964	1.000	0.979	1.000	0.941	1.000	0.955	0.938	1.000	1.000	0.929	0.900	0.784	0.950	0.970	0.946	0.933	0.889	1.000	0.900
Logistic Regression	0.885	1.000	0.889	0.941	0.923	0.875	0.889	0.938	1.000	0.944	1.000	1.000	0.979	1.000	0.979	0.800	1.000	0.938	1.000	1.000	0.929	1.000	0.784	1.000	0.845	0.946	1.000	0.909	1.000	0.900
Multi Layer Perceptron	0.957	1.000	0.833	0.941	0.920	0.917	0.889	0.938	1.000	0.944	0.978	0.962	0.979	1.000	0.979	1.000	1.000	0.898	1.000	1.000	0.929	1.000	0.784	1.000	0.860	0.975	1.000	0.909	1.000	1.000
Nearest Neighbors	0.921	1.000	0.889	0.979	0.938	0.875	0.927	0.938	0.927	0.974	0.964	1.000	0.941	1.000	0.941	0.984	0.981	0.938	1.000	1.000	0.895	0.900	0.884	1.000	0.845	0.971	0.967	0.982	1.000	0.884
Quadratic Discriminant Analysis	0.921	1.000	1.000	0.941	0.902	0.958	0.944	0.938	0.982	0.944	0.978	1.000	0.979	0.960	0.941	1.000	0.962	0.960	0.985	1.000	1.000	1.000	0.884	1.000	0.750	0.946	0.955	0.944	0.981	1.000
Random Forest	0.885	1.000	0.833	0.917	0.941	1.000	0.944	0.938	0.982	0.972	0.943	1.000	0.979	0.940	0.941	0.700	1.000	0.980	1.000	1.000	0.929	1.000	0.869	1.000	0.845	0.971	0.977	0.982	1.000	1.000
SVM - linear	0.885	1.000	0.944	0.941	0.920	0.875	0.889	0.980	1.000	0.944	0.978	1.000	0.979	0.980	0.979	0.900	0.955	0.938	1.000	1.000	0.912	0.900	0.784	1.000	0.845	0.975	1.000	0.964	1.000	0.900
SVM - poly	0.863	1.000	0.927	0.938	0.920	0.855	0.889	0.938	0.944	0.918	0.964	0.962	0.692	0.708	0.941	0.884	1.000	0.772	1.000	0.806	0.929	0.650	0.700	0.900	0.860	0.946	0.967	0.927	0.900	0.900
SVM - rbf	0.885	1.000	0.556	0.899	0.920	0.875	0.889	0.980	1.000	0.944	0.978	1.000	0.615	0.667	0.979	0.900	1.000	0.792	1.000	0.778	0.857	1.000	0.784	0.600	0.500	0.975	0.977	0.982	0.931	0.900

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.32 | AUROC score for 30 L*u*v* image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.885	1.000	1.000	0.938	0.941	0.917	0.944	0.980	0.982	0.972	0.964	0.962	0.979	0.940	0.941	0.700	1.000	0.898	1.000	1.000	0.929	1.000	0.869	1.000	0.970	0.946	0.977	0.944	0.981	0.969
Bernoulli Naive Bayes	0.935	1.000	1.000	0.861	0.938	0.980	0.982	0.980	0.964	0.944	0.921	1.000	0.979	0.940	0.979	0.969	0.942	0.940	0.970	1.000	0.967	1.000	0.969	0.981	0.924	0.975	0.955	0.982	0.981	0.953
Dummy Classifier	0.519	0.500	0.500	0.500	0.500	0.443	0.526	0.500	0.500	0.500	0.497	0.389	0.306	0.500	0.500	0.500	0.451	0.500	0.708	0.500	0.500	0.563	0.500	0.739	0.500	0.497	0.500	0.500	0.539	0.500
Extra Trees	0.921	1.000	0.944	0.899	0.941	1.000	0.944	0.938	1.000	0.946	0.943	1.000	0.979	1.000	0.979	0.900	0.962	0.960	1.000	1.000	0.983	0.850	0.500	1.000	0.500	0.946	0.944	0.667	0.981	0.900
Gaussian Naive Bayes	0.899	1.000	1.000	0.861	0.979	1.000	1.000	0.938	0.982	0.944	0.943	1.000	0.979	0.940	0.979	1.000	0.942	0.940	0.985	1.000	0.983	1.000	0.984	1.000	0.985	0.946	0.955	0.927	0.981	0.984
Gradient Boosting	0.863	1.000	0.944	0.920	0.902	0.917	0.944	0.855	0.944	0.972	0.929	1.000	0.979	0.898	0.979	1.000	1.000	0.960	1.000	1.000	1.000	1.000	0.969	1.000	0.720	0.946	0.977	0.944	1.000	0.984
Helstrom Quantum Classifier	0.935	1.000	1.000	0.878	0.958	1.000	0.944	0.980	0.982	0.918	1.000	0.979	0.979	0.960	0.979	0.984	1.000	0.940	0.985	1.000	0.895	1.000	0.884	1.000	0.879	0.971	0.911	0.982	0.981	0.900
Linear Discriminant Analysis	0.921	1.000	0.944	0.920	0.979	1.000	0.889	0.938	1.000	0.944	1.000	1.000	0.979	0.960	0.941	1.000	1.000	0.960	1.000	1.000	0.929	1.000	0.784	1.000	0.970	0.946	1.000	0.944	0.981	0.900
Logistic Regression	0.885	1.000	0.944	0.941	0.923	0.875	0.889	0.938	1.000	0.918	0.964	1.000	0.979	0.960	0.979	0.900	1.000	0.898	1.000	1.000	0.929	1.000	0.784	1.000	0.860	0.946	1.000	0.982	1.000	1.000
Multi Layer Perceptron	0.877	1.000	1.000	0.941	0.923	0.875	0.889	0.938	0.982	0.918	0.964	1.000	0.979	0.940	0.979	0.884	1.000	0.940	1.000	1.000	0.929	1.000	0.784	1.000	1.000	0.946	1.000	0.853	0.981	0.984
Nearest Neighbors	0.957	1.000	1.000	0.878	0.920	0.917	0.889	0.980	0.927	0.918	1.000	1.000	0.979	0.960	0.941	0.984	0.981	0.918	0.985	1.000	0.912	1.000	0.800	1.000	0.750	0.946	1.000	0.982	1.000	0.884
Quadratic Discriminant Analysis	0.885	1.000	1.000	0.941	0.902	0.958	0.944	0.938	0.964	0.944	1.000	1.000	0.979	0.960	0.979	0.900	0.981	0.918	0.985	1.000	0.929	1.000	0.884	1.000	1.000	0.946	0.955	1.000	0.981	0.984
Random Forest	0.885	1.000	0.944	0.938	0.941	0.958	0.889	0.938	0.982	0.944	0.907	1.000	0.979	0.940	0.941	0.700	1.000	0.960	1.000	1.000	0.929	1.000	0.984	1.000	0.985	0.946	0.977	0.944	0.981	0.984
SVM - linear	0.921	1.000	1.000	0.920	0.920	0.917	1.000	0.980	1.000	0.918	1.000	1.000	0.979	0.940	0.941	1.000	0.981	0.898	0.985	1.000	0.929	1.000	0.784	1.000	0.845	0.946	1.000	1.000	1.000	1.000
SVM - poly	0.885	1.000	1.000	0.899	0.941	0.875	0.889	0.980	0.982	0.918	0.964	1.000	0.902	0.958	0.941	0.800	0.909	0.938	0.985	1.000	0.929	1.000	0.784	0.950	0.860	0.946	0.900	0.778	1.000	0.884
SVM - rbf	0.821	1.000	0.722	0.920	0.958	0.917	0.889	0.980	0.982	0.944	1.000	1.000	0.979	0.960	0.979	1.000	0.864	0.940	0.500	1.000	0.929	1.000	0.500	0.550	0.500	0.946	0.833	1.000	0.650	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.33 | AUROC score for 30 contrast image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.834	0.981	0.964	0.697	0.700	0.897	0.946	0.920	0.800	0.861	0.655	0.878	0.854	0.753	0.721	0.769	0.885	0.713	0.955	0.893	0.812	0.944	0.669	0.826	0.500	0.715	0.820	0.891	0.881	0.906
Bernoulli Naive Bayes	0.762	0.890	0.964	0.686	0.739	0.835	0.853	0.855	0.722	0.706	0.699	0.745	0.665	0.650	0.591	0.569	0.741	0.423	0.720	0.614	0.560	0.844	0.500	0.813	0.500	0.715	0.786	0.744	0.807	0.822
Dummy Classifier	0.500	0.500	0.500	0.561	0.500	0.507	0.500	0.468	0.500	0.520	0.500	0.603	0.500	0.500	0.582	0.406	0.500	0.500	0.455	0.500	0.500	0.520	0.500	0.520	0.500	0.500	0.500	0.577	0.396	0.500
Extra Trees	0.500	0.500	0.500	0.641	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.778	0.799	0.760	0.668	0.627	0.625	0.760	0.750	0.611	0.632	0.542	0.612	0.591	0.565	0.686	0.500	0.598	0.503	0.735	0.532	0.417	0.750	0.584	0.631	0.610	0.538	0.776	0.722	0.631	0.684
Gradient Boosting	0.792	1.000	0.891	0.620	0.700	0.897	0.817	0.898	0.500	0.500	0.691	0.861	0.724	0.775	0.784	0.853	0.832	0.627	0.955	0.890	0.812	0.663	0.669	0.807	0.610	0.715	0.786	0.835	0.844	0.838
Helstrom Quantum Classifier	0.820	0.981	0.871	0.694	0.609	0.857	0.891	0.917	0.722	0.759	0.848	0.861	0.627	0.757	0.686	0.584	0.897	0.445	0.595	0.725	0.779	0.700	0.722	0.650	0.955	0.681	0.686	0.798	0.731	0.744
Linear Discriminant Analysis	0.756	0.708	0.631	0.707	0.588	0.627	0.760	0.792	0.611	0.550	0.562	0.612	0.591	0.565	0.532	0.500	0.500	0.442	0.735	0.531	0.526	0.750	0.584	0.650	0.610	0.538	0.776	0.760	0.731	0.569
Logistic Regression	0.756	0.818	0.687	0.686	0.683	0.668	0.760	0.833	0.667	0.550	0.699	0.612	0.647	0.565	0.532	0.500	0.500	0.462	0.735	0.531	0.510	0.731	0.484	0.631	0.485	0.568	0.776	0.760	0.713	0.569
Multi Layer Perceptron	0.820	0.981	0.982	0.543	0.683	0.813	0.891	0.833	0.667	0.810	0.719	0.920	0.745	0.628	0.822	0.553	0.897	0.588	0.610	0.892	0.795	0.894	0.800	0.644	0.625	0.803	0.786	0.817	0.731	0.822
Nearest Neighbors	0.877	0.916	0.815	0.795	0.659	0.793	0.837	0.918	0.631	0.785	0.891	0.899	0.745	0.673	0.647	0.569	0.962	0.525	0.720	0.784	0.740	0.813	0.584	0.663	0.625	0.832	0.786	0.762	0.944	0.822
Quadratic Discriminant Analysis	0.814	0.818	0.815	0.707	0.627	0.667	0.704	0.708	0.611	0.548	0.534	0.591	0.591	0.607	0.571	0.500	0.624	0.462	0.735	0.560	0.488	0.731	0.584	0.650	0.610	0.538	0.776	0.704	0.681	0.584
Random Forest	0.842	1.000	0.964	0.736	0.718	0.897	0.873	0.918	0.798	0.756	0.820	0.920	0.742	0.858	0.801	0.569	0.878	0.650	0.970	0.918	0.812	0.794	0.600	0.813	0.500	0.857	0.786	0.762	0.931	0.838
SVM - linear	0.699	0.909	0.853	0.707	0.721	0.585	0.853	0.897	0.611	0.523	0.649	0.553	0.630	0.565	0.434	0.500	0.500	0.462	0.735	0.529	0.433	0.650	0.500	0.631	0.500	0.538	0.776	0.780	0.731	0.600
SVM - poly	0.727	0.890	0.909	0.784	0.721	0.813	0.911	0.792	0.611	0.601	0.834	0.840	0.780	0.648	0.784	0.500	0.722	0.420	0.610	0.838	0.669	0.550	0.553	0.650	0.500	0.710	0.776	0.780	0.731	0.722
SVM - rbf	0.770	0.500	0.538	0.707	0.718	0.793	0.760	0.500	0.611	0.654	0.500	0.500	0.609	0.565	0.490	0.500	0.533	0.462	0.860	0.529	0.500	0.550	0.500	0.631	0.500	0.504	0.500	0.762	0.531	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.34 | AUROC score for 30 correlation image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.713	0.708	0.800	0.596	0.718	0.625	0.690	0.857	0.724	0.811	0.806	0.671	0.795	0.733	0.704	0.469	0.832	0.690	0.705	0.864	0.724	0.831	0.469	0.844	0.500	0.626	0.686	0.722	0.613	0.591
Bernoulli Naive Bayes	0.661	0.572	0.633	0.596	0.676	0.667	0.673	0.878	0.671	0.779	0.756	0.612	0.798	0.757	0.683	0.500	0.657	0.592	0.549	0.754	0.740	0.757	0.500	0.752	0.500	0.631	0.830	0.633	0.402	0.622
Dummy Classifier	0.500	0.586	0.500	0.537	0.543	0.525	0.433	0.343	0.500	0.500	0.547	0.500	0.484	0.547	0.466	0.606	0.540	0.500	0.500	0.513	0.500	0.539	0.500	0.500	0.500	0.500	0.586	0.393	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.537	0.630	0.500	0.500	0.667	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.669	0.806	0.780	0.596	0.736	0.750	0.653	0.918	0.706	0.702	0.762	0.651	0.819	0.755	0.623	0.500	0.832	0.652	0.705	0.725	0.812	0.813	0.684	0.844	0.625	0.656	0.686	0.780	0.576	0.622
Gradient Boosting	0.727	0.832	0.891	0.617	0.756	0.750	0.746	0.857	0.724	0.730	0.812	0.721	0.641	0.733	0.644	0.453	0.696	0.650	0.705	0.890	0.790	0.750	0.669	0.794	0.625	0.676	0.676	0.651	0.744	0.606
Helstrom Quantum Classifier	0.790	0.806	0.873	0.635	0.662	0.750	0.673	0.898	0.837	0.759	0.733	0.760	0.816	0.735	0.724	0.859	0.677	0.590	0.814	0.808	0.812	0.894	0.738	0.813	0.955	0.676	0.653	0.873	0.733	0.628
Linear Discriminant Analysis	0.612	0.670	0.780	0.596	0.676	0.688	0.671	0.877	0.706	0.677	0.719	0.651	0.819	0.795	0.567	0.600	0.832	0.547	0.595	0.697	0.812	0.781	0.569	0.794	0.500	0.543	0.653	0.817	0.676	0.622
Logistic Regression	0.598	0.670	0.780	0.596	0.676	0.688	0.688	0.877	0.651	0.677	0.683	0.651	0.819	0.773	0.567	0.600	0.832	0.567	0.595	0.670	0.669	0.731	0.584	0.794	0.500	0.543	0.620	0.853	0.594	0.622
Multi Layer Perceptron	0.762	0.806	0.891	0.620	0.659	0.750	0.673	0.837	0.651	0.705	0.705	0.819	0.742	0.715	0.571	0.500	0.710	0.483	0.580	0.863	0.581	0.731	0.784	0.844	0.625	0.719	0.686	0.780	0.600	0.622
Nearest Neighbors	0.870	0.794	0.744	0.593	0.697	0.750	0.599	0.795	0.855	0.757	0.804	0.784	0.704	0.797	0.721	0.784	0.722	0.673	0.845	0.807	0.900	0.794	0.700	0.844	0.500	0.765	0.653	0.835	0.739	0.706
Quadratic Discriminant Analysis	0.705	0.760	0.891	0.575	0.736	0.708	0.597	0.918	0.706	0.730	0.711	0.710	0.857	0.775	0.665	0.500	0.624	0.547	0.580	0.697	0.740	0.831	0.784	0.826	0.625	0.685	0.653	0.927	0.720	0.506
Random Forest	0.806	0.760	0.835	0.599	0.739	0.708	0.690	0.918	0.817	0.784	0.755	0.748	0.683	0.755	0.571	0.584	0.787	0.608	0.845	0.835	0.774	0.800	0.584	0.794	0.500	0.735	0.742	0.760	0.881	0.606
SVM - linear	0.683	0.689	0.780	0.575	0.676	0.688	0.653	0.857	0.726	0.702	0.769	0.651	0.819	0.755	0.606	0.500	0.832	0.610	0.580	0.725	0.829	0.781	0.500	0.844	0.500	0.601	0.653	0.909	0.500	0.622
SVM - poly	0.620	0.825	0.853	0.593	0.638	0.750	0.599	0.858	0.651	0.784	0.784	0.538	0.742	0.733	0.647	0.500	0.787	0.442	0.705	0.810	0.833	0.731	0.538	0.826	0.595	0.647	0.630	0.611	0.670	0.522
SVM - rbf	0.683	0.689	0.500	0.575	0.500	0.688	0.635	0.500	0.500	0.674	0.769	0.500	0.500	0.817	0.641	0.500	0.500	0.500	0.564	0.725	0.500	0.500	0.500	0.794	0.500	0.601	0.500	0.909	0.776	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.35 | AUROC score for 30 energy image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.812	1.000	0.964	0.774	0.756	0.897	0.835	0.980	0.964	0.864	0.699	0.861	0.833	0.878	0.780	0.700	0.760	0.778	0.845	0.944	0.829	1.000	0.769	0.881	0.500	0.862	0.898	0.891	0.900	0.891
Bernoulli Naive Bayes	0.783	0.677	0.837	0.771	0.792	0.690	0.839	0.920	0.837	0.807	0.856	0.630	0.683	0.860	0.816	0.500	0.865	0.695	0.500	0.868	0.779	0.500	0.500	0.652	0.500	0.626	0.864	0.575	0.565	0.753
Dummy Classifier	0.500	0.437	0.542	0.500	0.505	0.500	0.635	0.612	0.395	0.500	0.500	0.470	0.500	0.385	0.564	0.500	0.502	0.500	0.500	0.402	0.707	0.500	0.422	0.415	0.500	0.500	0.395	0.500	0.500	0.500
Extra Trees	0.500	0.500	0.500	0.739	0.538	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.798	1.000	0.964	0.795	0.833	0.917	0.835	0.980	0.982	0.806	0.790	0.938	0.899	0.878	0.833	0.853	0.878	0.778	0.955	0.946	0.900	1.000	0.953	0.913	0.750	0.866	0.876	0.929	0.876	0.844
Gradient Boosting	0.742	0.955	0.853	0.774	0.816	0.813	0.853	0.813	0.835	0.836	0.627	0.822	0.700	0.795	0.739	0.669	0.806	0.757	0.955	0.944	0.757	1.000	0.884	0.844	0.610	0.832	0.898	0.891	0.844	0.922
Helstrom Quantum Classifier	0.826	0.923	0.946	0.753	0.574	0.792	0.911	0.920	0.893	0.779	0.848	0.941	0.854	0.880	0.875	0.953	0.923	0.800	0.909	0.920	0.867	0.781	0.884	0.926	0.924	0.950	0.876	0.873	0.876	0.797
Linear Discriminant Analysis	0.870	0.825	0.964	0.712	0.812	0.772	0.929	0.940	0.964	0.702	0.812	0.615	0.837	0.900	0.840	0.600	0.904	0.673	0.485	0.920	0.795	0.800	0.500	0.550	0.500	0.744	0.865	0.780	0.881	0.900
Logistic Regression	0.798	1.000	0.964	0.795	0.756	0.897	0.946	0.980	0.982	0.889	0.784	0.822	0.875	0.898	0.854	0.884	0.878	0.778	0.830	0.946	0.795	0.950	0.500	0.863	0.500	0.891	0.898	0.946	0.863	0.838
Multi Layer Perceptron	0.798	1.000	0.964	0.756	0.736	0.813	0.946	0.960	0.760	0.890	0.842	0.822	0.875	0.878	0.724	0.753	0.897	0.715	0.830	0.863	0.812	1.000	0.769	0.863	0.750	0.891	0.876	0.946	0.931	0.838
Nearest Neighbors	0.848	0.962	0.853	0.771	0.812	0.833	0.893	0.960	0.835	0.782	0.848	0.979	0.837	0.797	0.816	0.869	0.942	0.715	0.955	0.946	0.883	0.881	0.900	0.876	0.625	0.941	0.865	0.762	0.963	0.906
Quadratic Discriminant Analysis	0.798	1.000	0.964	0.795	0.833	0.958	0.835	0.980	0.964	0.806	0.755	0.938	0.840	0.878	0.833	0.853	0.878	0.798	0.830	0.946	0.900	1.000	1.000	0.913	0.750	0.891	0.898	0.929	0.894	0.844
Random Forest	0.784	1.000	0.964	0.795	0.777	0.855	0.853	0.980	0.760	0.892	0.685	0.861	0.878	0.898	0.840	0.569	0.878	0.652	0.970	0.972	0.900	0.950	0.500	0.863	0.500	0.891	0.898	0.946	0.900	0.938
SVM - linear	0.834	1.000	0.964	0.753	0.812	0.980	0.946	0.940	0.964	0.833	0.812	0.938	0.833	0.858	0.833	0.500	0.923	0.778	0.955	0.946	0.867	0.850	0.584	0.944	0.500	0.774	0.876	0.946	0.876	0.844
SVM - poly	0.891	1.000	0.964	0.753	0.736	0.897	0.929	0.940	0.911	0.811	0.870	0.857	0.854	0.838	0.833	0.500	0.897	0.757	0.955	0.946	0.867	0.800	0.669	0.813	0.610	0.921	0.876	0.780	0.863	0.891
SVM - rbf	0.848	1.000	0.964	0.753	0.812	0.980	0.835	0.940	0.964	0.833	0.790	0.938	0.833	0.858	0.833	0.500	0.500	0.778	0.955	0.946	0.867	1.000	0.584	0.944	0.500	0.925	0.876	0.929	0.826	0.844

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.36 | AUROC score for 30 homogeneity image feature datasets for cell line MCF7

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.848	0.981	0.964	0.774	0.854	0.772	0.891	0.980	0.891	0.890	0.792	0.843	0.837	0.858	0.739	0.684	0.832	0.758	0.845	0.944	0.829	0.981	0.969	0.963	0.500	0.921	0.909	0.835	0.900	0.938
Bernoulli Naive Bayes	0.848	0.981	0.964	0.792	0.812	0.817	0.929	0.980	0.946	0.778	0.806	0.766	0.857	0.838	0.854	0.638	0.885	0.758	0.769	0.946	0.900	0.844	0.500	0.944	0.500	0.950	0.886	0.911	0.870	0.838
Dummy Classifier	0.500	0.500	0.500	0.540	0.558	0.482	0.399	0.385	0.615	0.500	0.500	0.500	0.484	0.500	0.442	0.453	0.500	0.500	0.500	0.539	0.500	0.500	0.500	0.500	0.470	0.531	0.474	0.562	0.500	0.344
Extra Trees	0.500	0.500	0.500	0.816	0.651	0.500	0.500	0.500	0.500	0.500	0.536	0.500	0.500	0.647	0.556	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.598	0.500	0.500	0.500
Gaussian Naive Bayes	0.820	1.000	0.964	0.774	0.837	0.938	0.891	0.938	0.982	0.890	0.669	0.899	0.878	0.878	0.875	0.869	0.897	0.695	0.970	0.918	0.829	0.981	0.869	0.963	0.750	0.916	0.898	0.873	0.894	0.891
Gradient Boosting	0.786	1.000	0.964	0.736	0.854	0.813	0.891	0.938	0.780	0.864	0.727	0.881	0.784	0.858	0.683	0.769	0.741	0.757	0.970	0.835	0.500	0.981	1.000	0.913	0.610	0.774	0.909	0.946	0.881	0.969
Helstrom Quantum Classifier	0.870	0.981	0.964	0.736	0.718	0.855	0.946	0.897	0.946	0.835	0.812	0.938	0.780	0.838	0.875	0.853	0.839	0.758	0.955	0.946	0.900	0.944	0.953	0.913	0.955	0.950	0.932	0.873	0.900	0.828
Linear Discriminant Analysis	0.812	0.981	0.964	0.774	0.854	0.960	0.946	0.980	0.964	0.835	0.669	0.938	0.878	0.838	0.798	0.784	0.897	0.695	0.970	0.890	0.900	0.981	0.869	0.963	0.610	0.921	0.932	0.817	0.913	0.891
Logistic Regression	0.820	1.000	1.000	0.774	0.875	0.897	0.909	0.897	0.909	0.920	0.691	0.822	0.878	0.837	0.798	0.684	0.897	0.673	0.970	0.890	0.845	1.000	0.769	0.913	0.500	0.774	0.898	0.835	0.863	0.906
Multi Layer Perceptron	0.820	1.000	0.964	0.774	0.795	0.855	0.909	0.980	0.982	0.864	0.727	0.822	0.840	0.837	0.917	0.869	0.916	0.695	0.970	0.920	0.917	1.000	0.784	0.963	0.500	0.891	0.898	0.835	0.863	0.953
Nearest Neighbors	0.856	0.981	0.909	0.753	0.812	0.855	0.946	0.980	0.780	0.836	0.776	0.920	0.784	0.858	0.798	0.669	0.858	0.717	0.970	0.946	0.900	1.000	0.700	0.963	0.500	0.950	0.898	0.817	0.963	0.806
Quadratic Discriminant Analysis	0.856	1.000	0.964	0.736	0.875	0.938	0.891	0.938	0.964	0.918	0.669	0.938	0.840	0.878	0.837	0.869	0.878	0.735	0.970	0.890	0.900	0.981	0.800	0.963	0.625	0.891	0.898	0.817	0.913	0.791
Random Forest	0.820	1.000	0.964	0.816	0.837	0.772	0.909	0.980	0.853	0.839	0.842	0.861	0.801	0.838	0.763	0.769	0.878	0.673	0.970	0.944	0.883	0.981	0.700	0.963	0.500	0.862	0.898	0.817	0.900	0.938
SVM - linear	0.848	0.981	0.964	0.771	0.854	0.960	0.946	0.980	0.964	0.835	0.776	0.938	0.878	0.838	0.875	0.584	0.878	0.695	0.970	0.918	0.900	0.981	0.500	0.963	0.500	0.832	0.932	0.873	0.913	0.906
SVM - poly	0.870	0.981	0.964	0.792	0.812	0.897	0.946	0.980	0.964	0.811	0.798	0.938	0.917	0.627	0.854	0.969	0.916	0.695	0.970	0.920	0.900	1.000	0.584	0.963	0.500	0.862	0.932	0.873	0.881	0.853
SVM - rbf	0.500	0.981	0.500	0.812	0.854	0.500	0.946	0.980	0.964	0.500	0.705	0.938	0.500	0.838	0.500	0.500	0.897	0.500	0.500	0.918	0.900	0.500	0.684	0.500	0.500	0.832	0.932	0.500	0.913	0.906

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.37 | Balanced accuracy score for 30 RGB image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.917	0.925	0.946	0.955	0.900	0.943	0.839	0.921	0.962	1.000	0.900	0.929	0.921	0.832	0.923	0.871	0.917	0.927	0.893	0.907	0.900	0.920	1.000	0.938	0.955	0.912	0.929	0.786	0.795	0.871
Bernoulli Naive Bayes	0.917	0.875	0.944	0.955	0.933	0.913	0.895	0.886	0.955	0.866	0.825	0.929	0.906	0.932	0.923	0.846	0.854	0.927	0.867	0.857	0.850	0.868	0.921	0.858	0.955	0.840	0.946	0.757	0.833	0.871
Dummy Classifier	0.500	0.582	0.500	0.500	0.642	0.441	0.500	0.662	0.500	0.644	0.500	0.421	0.500	0.405	0.546	0.500	0.526	0.397	0.598	0.500	0.500	0.401	0.500	0.505	0.437	0.500	0.500	0.400	0.500	0.500
Extra Trees	0.875	0.875	0.889	0.955	0.800	0.978	0.918	0.898	0.955	0.891	0.950	0.929	0.945	0.955	0.923	0.812	0.896	0.778	0.763	0.821	0.800	0.895	0.933	0.667	0.682	0.643	0.500	0.500	0.750	0.778
Gaussian Naive Bayes	0.897	0.925	0.944	0.935	0.967	0.957	0.895	0.955	0.935	1.000	0.900	0.929	0.945	0.921	0.923	0.871	0.896	0.927	0.841	0.857	0.850	0.947	0.921	0.938	0.955	0.824	0.944	0.769	0.792	0.871
Gradient Boosting	0.917	0.925	0.946	0.955	1.000	0.943	0.921	0.888	0.981	1.000	0.887	0.929	0.897	0.977	0.902	0.896	0.878	0.927	0.893	0.929	0.831	0.920	0.967	0.938	0.955	0.912	0.929	0.769	0.835	0.871
Helstrom Quantum Classifier	0.917	0.950	0.944	1.000	0.933	0.935	0.947	0.932	0.981	0.950	0.875	0.929	0.906	0.955	0.923	0.900	0.854	0.871	0.893	0.929	0.850	0.921	0.944	0.960	0.955	0.807	0.944	0.807	0.917	0.871
Linear Discriminant Analysis	0.917	0.875	0.861	0.955	0.867	0.935	0.947	0.932	0.981	0.925	0.841	0.929	0.906	0.955	0.923	0.900	0.816	0.889	0.842	0.800	0.800	0.947	0.967	0.960	0.955	0.786	0.944	0.786	0.792	0.815
Logistic Regression	0.897	0.950	0.944	0.955	0.933	0.978	0.947	0.932	0.962	0.975	0.866	0.929	0.897	0.955	0.923	0.871	0.837	0.891	0.893	0.871	0.831	0.947	0.967	0.938	0.955	0.840	0.964	0.786	0.833	0.871
Multi Layer Perceptron	0.877	0.950	0.946	0.955	0.933	0.978	0.920	0.955	0.981	0.921	0.900	0.929	0.897	0.955	0.923	0.871	0.837	0.891	0.893	0.899	0.913	0.921	0.967	0.938	0.955	0.840	0.964	0.786	0.878	0.871
Nearest Centroid	0.897	0.900	0.889	0.955	0.867	0.935	0.895	0.909	1.000	0.900	0.850	0.929	0.906	0.955	0.923	0.900	0.854	0.889	0.867	0.857	0.850	0.895	0.967	0.900	0.955	0.840	0.889	0.752	0.772	0.871
Nearest Neighbors	0.897	0.950	0.944	0.955	0.933	0.957	0.921	0.955	0.962	0.971	0.891	0.929	0.866	0.888	0.923	0.900	0.798	0.889	0.920	0.964	0.850	0.921	0.921	0.980	0.909	0.840	0.982	0.840	0.837	0.927
Passive Aggressive Classifier	0.877	0.799	0.944	0.955	0.809	0.907	0.781	0.898	0.962	1.000	0.765	0.912	0.731	0.955	0.941	0.900	0.878	0.891	0.893	0.885	0.850	0.865	1.000	0.897	0.755	0.840	0.891	0.786	0.818	0.871
Perceptron	0.917	0.950	0.944	0.955	0.933	0.957	0.920	0.821	0.885	0.971	0.882	0.929	0.842	0.888	0.816	0.871	0.875	0.909	0.893	0.835	0.963	0.947	0.967	0.938	0.955	0.840	0.982	0.786	0.813	0.871
Quadratic Discriminant Analysis	0.897	0.975	0.972	0.935	0.967	0.978	0.974	0.898	0.962	0.971	0.925	0.929	0.921	0.977	0.902	0.871	0.875	0.909	0.893	0.893	0.831	0.947	1.000	0.980	0.955	0.840	0.982	0.786	0.833	0.927
Random Forest	0.917	0.900	0.972	0.955	0.967	0.943	0.921	0.955	0.981	1.000	0.950	0.929	0.921	0.977	0.923	0.896	0.896	0.927	0.893	0.964	0.850	0.946	1.000	0.938	0.955	0.840	0.929	0.786	0.875	0.871
SVM - linear	0.897	0.950	0.944	0.955	0.967	0.957	0.947	0.932	0.962	0.975	0.900	0.929	0.938	0.955	0.923	0.871	0.875	0.927	0.893	0.871	0.850	0.921	0.967	0.980	0.909	0.840	0.944	0.786	0.833	0.871
SVM - poly	0.877	0.950	0.972	0.955	1.000	0.957	0.947	0.955	0.962	1.000	0.900	0.929	0.906	0.955	0.923	0.896	0.875	0.891	0.893	0.964	0.850	0.947	0.977	0.980	0.955	0.840	0.964	0.769	0.898	0.853
SVM - rbf	0.917	0.950	0.944	0.955	0.933	0.957	0.947	0.909	0.962	0.975	0.900	0.929	0.914	0.955	0.923	0.871	0.875	0.927	0.895	0.835	0.850	0.921	0.967	0.980	0.955	0.840	0.944	0.786	0.792	0.871

Table 4.38 | Balanced accuracy score for 30 L*u*v* image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.897	0.925	0.944	0.909	0.933	0.943	0.920	0.888	1.000	0.971	0.891	0.929	0.921	0.888	0.923	0.871	0.819	0.927	0.893	0.921	0.831	0.895	0.967	0.938	0.955	0.895	0.964	0.840	0.795	0.871
Bernoulli Naive Bayes	0.897	0.900	0.944	0.955	0.967	0.913	0.895	0.909	0.955	0.900	0.900	0.929	0.906	0.955	0.923	0.846	0.854	0.927	0.865	0.893	0.850	0.895	0.967	0.900	0.955	0.912	0.909	0.786	0.813	0.871
Dummy Classifier	0.508	0.500	0.539	0.500	0.405	0.500	0.542	0.527	0.500	0.500	0.500	0.350	0.479	0.500	0.404	0.431	0.561	0.500	0.461	0.500	0.420	0.500	0.500	0.500	0.500	0.636	0.500	0.433	0.632	0.500
Extra Trees	0.875	0.875	0.917	0.955	0.867	0.978	0.895	0.932	0.955	0.832	0.853	0.929	0.866	0.955	0.885	0.871	0.875	0.722	0.737	0.893	0.850	0.947	0.967	0.980	0.864	0.769	0.833	0.500	0.708	0.871
Gaussian Naive Bayes	0.897	0.950	0.944	0.955	0.900	0.978	0.947	0.932	0.935	0.946	0.900	0.929	0.890	0.977	0.902	0.841	0.875	0.927	0.893	0.893	0.831	0.947	1.000	0.980	0.955	0.824	0.927	0.786	0.833	0.871
Gradient Boosting	0.897	0.925	0.944	0.935	0.933	0.943	0.920	0.888	0.981	0.975	0.862	0.929	0.874	0.955	0.902	0.837	0.857	0.909	0.893	0.943	0.813	0.892	1.000	0.980	0.955	0.895	0.929	0.769	0.815	0.853
Helstrom Quantum Classifier	0.897	0.875	0.895	0.955	0.867	0.899	0.921	0.944	0.909	0.925	0.925	0.929	0.882	0.877	0.923	0.871	0.854	0.889	0.921	0.893	0.831	0.893	1.000	0.980	0.955	0.895	0.946	0.824	0.917	0.909
Linear Discriminant Analysis	0.917	0.900	0.861	0.955	0.867	0.935	0.947	0.932	0.955	0.950	0.841	0.929	0.906	0.955	0.923	0.900	0.854	0.889	0.868	0.871	0.850	0.947	0.967	0.960	0.955	0.840	0.944	0.786	0.833	0.871
Logistic Regression	0.897	0.950	0.944	0.955	0.933	0.978	0.947	0.932	0.962	0.950	0.896	0.929	0.921	0.955	0.923	0.871	0.875	0.891	0.893	0.893	0.881	0.947	1.000	0.938	0.955	0.840	0.946	0.786	0.875	0.871
Multi Layer Perceptron	0.897	0.950	1.000	0.955	0.933	0.978	0.920	0.932	0.962	0.946	0.875	0.929	0.897	0.977	0.923	0.871	0.875	0.891	0.893	1.000	0.831	0.947	1.000	0.938	0.955	0.879	0.964	0.840	0.897	0.871
Nearest Centroid	0.875	0.875	0.889	0.955	0.833	0.935	0.868	0.909	0.955	0.900	0.825	0.929	0.882	0.955	0.923	0.871	0.833	0.889	0.893	0.893	0.850	0.895	0.967	0.960	0.955	0.840	0.944	0.786	0.813	0.871
Nearest Neighbors	0.917	0.900	0.944	1.000	0.900	0.943	0.921	0.832	0.962	0.950	0.891	0.929	0.890	0.933	0.920	0.871	0.819	0.889	0.868	0.978	0.850	0.867	1.000	0.938	0.955	0.824	0.909	0.840	0.833	0.927
Passive Aggressive Classifier	0.917	0.900	0.839	0.955	0.877	0.907	0.920	0.898	0.942	0.912	0.896	0.929	0.969	0.732	0.902	0.841	0.784	0.909	0.893	0.856	0.950	0.725	0.967	0.980	0.864	0.840	0.946	0.719	0.817	0.837
Perceptron	0.897	0.950	0.841	0.981	0.821	0.957	0.861	0.876	0.923	1.000	0.857	0.929	0.874	0.888	0.923	0.778	0.801	0.909	0.893	0.871	0.850	0.836	0.967	0.938	0.955	0.912	0.944	0.752	0.815	0.873
Quadratic Discriminant Analysis	0.897	0.975	0.972	0.955	0.967	0.943	0.974	0.932	0.942	0.971	0.896	0.929	0.921	0.977	0.902	0.871	0.875	0.909	0.893	0.907	0.850	0.947	1.000	0.980	0.955	0.840	0.982	0.786	0.833	0.927
Random Forest	0.917	0.925	0.944	0.955	0.967	0.943	0.920	0.921	0.981	0.971	0.862	0.929	0.897	0.977	0.923	0.866	0.875	0.927	0.893	0.893	0.831	0.946	1.000	0.980	0.955	0.895	0.929	0.786	0.875	0.871
SVM - linear	0.897	0.950	0.944	0.955	0.967	0.978	0.947	0.932	1.000	0.950	0.925	0.929	0.906	0.955	0.923	0.871	0.875	0.927	0.867	0.871	0.850	0.921	0.967	0.938	0.955	0.840	0.927	0.786	0.792	0.871
SVM - poly	0.897	0.975	0.972	1.000	0.867	0.957	0.947	0.932	1.000	0.975	0.866	0.929	0.890	0.921	0.864	0.871	0.798	0.909	0.893	0.978	0.831	0.895	1.000	0.980	0.955	0.840	0.964	0.786	0.775	0.853
SVM - rbf	0.897	0.950	0.944	0.955	0.967	0.978	0.947	0.932	1.000	0.975	0.900	0.929	0.914	0.955	0.923	0.871	0.875	0.927	0.867	0.893	0.850	0.921	0.967	0.938	0.955	0.840	0.982	0.786	0.792	0.871

Table 4.39 | Balanced accuracy score for 30 contrast image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	0.971	0.974	0.981	0.933	0.978	1.000	0.921	0.962	1.000	0.975	1.000	1.000	0.967	1.000	0.975	0.979	0.927	0.946	0.978	0.950	0.972	0.977	0.958	1.000	0.983	0.889	0.950	0.938	0.982
Bernoulli Naive Bayes	0.958	0.946	0.974	1.000	0.900	0.826	0.974	0.886	0.981	0.950	0.900	1.000	0.906	0.886	0.962	0.900	0.920	0.909	0.946	0.929	0.950	0.947	0.944	0.735	1.000	0.983	0.964	0.967	0.897	0.982
Dummy Classifier	0.500	0.500	0.500	0.509	0.500	0.447	0.500	0.561	0.549	0.500	0.500	0.367	0.519	0.506	0.484	0.481	0.502	0.452	0.547	0.467	0.500	0.500	0.500	0.547	0.500	0.581	0.500	0.500	0.500	0.321
Extra Trees	0.708	0.850	0.861	0.500	0.867	0.500	1.000	0.967	0.981	0.882	0.824	0.714	0.738	0.921	0.846	0.803	0.808	0.500	0.500	0.929	0.500	0.974	0.744	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	1.000	0.971	0.974	1.000	0.967	1.000	1.000	0.944	0.962	0.971	0.975	1.000	1.000	0.911	1.000	0.975	0.979	0.909	0.972	0.929	0.981	0.974	0.977	0.960	1.000	0.983	0.964	0.950	0.875	0.982
Gradient Boosting	1.000	0.971	1.000	0.981	0.933	0.978	0.972	0.921	0.916	1.000	0.975	1.000	0.976	0.944	1.000	0.916	0.941	0.927	0.920	0.978	0.950	0.890	0.977	0.958	1.000	0.912	0.889	0.967	0.958	0.982
Helstrom Quantum Classifier	0.958	0.971	1.000	1.000	0.967	0.978	1.000	0.921	0.981	1.000	0.925	1.000	0.938	0.955	1.000	0.975	0.958	0.927	0.972	0.964	0.950	0.974	0.977	0.980	1.000	0.983	0.889	0.983	0.875	0.982
Linear Discriminant Analysis	0.958	0.921	0.946	0.955	0.867	0.978	0.974	0.921	0.981	1.000	0.950	0.929	0.938	0.932	0.962	0.900	0.938	0.871	0.893	0.893	0.900	0.947	0.911	0.980	0.909	0.912	0.889	0.643	0.875	0.815
Logistic Regression	1.000	0.946	0.974	1.000	0.933	0.978	1.000	0.944	0.962	1.000	0.950	0.929	1.000	0.911	1.000	0.950	0.979	0.927	0.972	0.964	0.950	0.974	0.977	0.980	1.000	0.983	0.944	0.967	0.875	0.982
Multi Layer Perceptron	1.000	0.946	0.974	1.000	0.933	0.978	1.000	0.876	0.962	1.000	0.950	1.000	1.000	0.967	1.000	0.950	0.958	0.927	0.972	0.964	0.950	0.974	0.977	0.980	1.000	0.983	0.889	0.983	0.875	0.982
Nearest Centroid	0.958	0.946	0.974	0.955	0.867	0.935	0.947	0.944	0.962	0.921	0.950	0.929	0.882	0.888	0.878	0.871	0.875	0.927	0.972	0.964	0.900	0.920	0.944	0.900	0.955	0.983	0.889	0.912	0.938	0.927
Nearest Neighbors	1.000	0.971	1.000	1.000	0.967	0.978	1.000	0.898	0.890	1.000	1.000	1.000	0.976	0.955	0.962	0.975	0.958	0.927	1.000	0.964	0.950	0.946	0.977	0.938	1.000	0.983	1.000	0.983	0.897	0.982
Passive Aggressive Classifier	1.000	0.946	0.974	1.000	0.967	0.978	1.000	0.898	0.962	1.000	0.853	1.000	0.952	0.911	0.979	0.900	0.958	0.927	0.972	0.978	0.950	0.808	0.977	0.958	1.000	0.983	0.889	0.983	0.838	0.982
Perceptron	1.000	0.946	0.974	0.923	0.967	1.000	1.000	0.944	0.981	1.000	0.916	1.000	1.000	0.888	0.923	0.850	0.958	0.927	0.946	0.929	0.950	0.694	0.977	0.938	1.000	0.983	0.944	0.917	0.897	0.982
Quadratic Discriminant Analysis	1.000	0.971	0.974	1.000	0.967	1.000	1.000	0.944	0.962	0.971	0.975	1.000	1.000	0.911	1.000	0.975	0.979	0.927	0.972	0.964	0.981	0.974	0.977	0.980	1.000	0.983	0.964	0.967	0.875	0.982
Random Forest	1.000	0.971	1.000	1.000	1.000	0.978	1.000	0.921	0.962	1.000	0.975	1.000	1.000	0.967	1.000	0.975	0.979	0.871	0.972	1.000	0.950	0.947	0.977	0.958	1.000	1.000	0.889	0.967	0.938	0.982
SVM - linear	1.000	0.971	0.974	1.000	0.967	0.978	1.000	0.944	0.962	1.000	0.950	1.000	1.000	0.911	1.000	0.975	0.958	0.927	0.972	0.964	0.931	0.974	0.977	0.980	1.000	0.983	0.944	0.967	0.897	0.982
SVM - poly	1.000	0.971	1.000	1.000	0.967	1.000	1.000	0.921	0.962	1.000	0.975	1.000	1.000	0.944	1.000	0.975	0.979	0.927	0.972	0.964	0.950	0.947	0.977	0.980	1.000	0.983	0.944	0.950	0.897	0.982
SVM - rbf	1.000	0.971	0.974	1.000	0.967	0.978	1.000	0.921	0.962	1.000	0.950	1.000	1.000	0.911	1.000	0.946	0.958	0.927	0.972	0.964	0.950	0.974	0.977	0.980	1.000	0.983	1.000	0.967	0.855	0.982

Table 4.40 | Balanced accuracy score for 30 correlation image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.608	0.812	0.759	0.715	0.830	0.764	0.811	0.742	0.858	0.812	0.803	0.736	0.778	0.820	0.718	0.703	0.840	0.817	0.759	0.848	0.781	0.700	0.553	0.633	0.780	0.857	0.927	0.681	0.813	0.871
Bernoulli Naive Bayes	0.528	0.657	0.754	0.500	0.562	0.500	0.838	0.608	0.858	0.565	0.665	0.840	0.676	0.797	0.665	0.574	0.763	0.556	0.548	0.592	0.681	0.620	0.655	0.672	0.689	0.736	0.500	0.450	0.753	0.669
Dummy Classifier	0.500	0.494	0.500	0.500	0.618	0.500	0.355	0.500	0.500	0.447	0.500	0.405	0.424	0.500	0.561	0.500	0.428	0.377	0.572	0.500	0.500	0.500	0.483	0.490	0.444	0.500	0.431	0.526	0.425	0.577
Extra Trees	0.500	0.500	0.779	0.500	0.577	0.500	0.754	0.744	0.871	0.647	0.529	0.500	0.500	0.752	0.500	0.665	0.538	0.500	0.500	0.536	0.500	0.727	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.523	0.607	0.731	0.526	0.742	0.693	0.811	0.686	0.813	0.703	0.732	0.752	0.723	0.718	0.739	0.703	0.739	0.502	0.577	0.635	0.813	0.730	0.755	0.732	0.591	0.769	0.760	0.643	0.730	0.760
Gradient Boosting	0.733	0.896	0.917	0.753	0.842	0.921	0.754	0.877	0.904	0.891	0.803	0.912	0.833	0.888	0.857	0.791	0.819	0.909	0.816	0.762	0.813	0.835	0.730	0.938	0.864	0.857	0.927	0.769	0.793	0.944
Helstrom Quantum Classifier	0.673	0.687	0.864	0.677	0.698	0.778	0.863	0.732	0.748	0.812	0.871	0.840	0.810	0.798	0.837	0.737	0.739	0.871	0.918	0.806	0.763	0.782	0.855	0.878	0.671	0.840	0.891	0.745	0.772	0.817
Linear Discriminant Analysis	0.545	0.657	0.731	0.526	0.620	0.585	0.728	0.653	0.767	0.649	0.694	0.786	0.771	0.741	0.700	0.728	0.662	0.484	0.550	0.542	0.794	0.649	0.709	0.648	0.617	0.840	0.722	0.643	0.710	0.760
Logistic Regression	0.545	0.657	0.731	0.545	0.620	0.585	0.728	0.653	0.767	0.649	0.694	0.786	0.795	0.741	0.721	0.753	0.662	0.484	0.550	0.542	0.794	0.649	0.709	0.648	0.617	0.840	0.722	0.643	0.710	0.760
Multi Layer Perceptron	0.690	0.678	0.946	0.981	0.967	0.885	0.864	0.753	0.767	0.821	0.853	0.912	0.787	0.865	0.979	0.841	0.801	0.982	0.920	0.806	0.744	0.727	0.855	0.918	0.864	0.824	0.780	0.719	0.752	0.817
Nearest Centroid	0.553	0.724	0.731	0.645	0.664	0.626	0.728	0.664	0.839	0.599	0.762	0.757	0.732	0.786	0.739	0.653	0.739	0.524	0.623	0.477	0.802	0.727	0.697	0.552	0.767	0.845	0.655	0.669	0.815	0.726
Nearest Neighbors	0.732	0.707	0.892	0.806	0.798	0.849	0.864	0.788	0.851	0.921	0.857	1.000	0.874	0.832	0.822	0.841	0.795	0.946	0.813	0.863	0.863	0.754	0.865	0.897	0.773	0.840	0.964	0.593	0.795	0.873
Passive Aggressive Classifier	0.470	0.410	0.320	0.528	0.483	0.641	0.643	0.509	0.664	0.581	0.549	0.779	0.676	0.686	0.756	0.782	0.413	0.562	0.500	0.477	0.600	0.542	0.548	0.500	0.500	0.667	0.500	0.664	0.595	0.710
Perceptron	0.490	0.381	0.626	0.469	0.609	0.620	0.813	0.568	0.724	0.732	0.543	0.707	0.549	0.291	0.739	0.678	0.593	0.526	0.570	0.669	0.683	0.623	0.559	0.500	0.559	0.733	0.484	0.450	0.425	0.671
Quadratic Discriminant Analysis	0.483	0.599	0.782	0.526	0.709	0.728	0.784	0.698	0.767	0.753	0.732	0.857	0.795	0.774	0.760	0.703	0.756	0.593	0.604	0.679	0.826	0.703	0.755	0.752	0.636	0.752	0.742	0.610	0.730	0.760
Random Forest	0.627	0.791	0.861	0.636	0.888	0.849	0.781	0.798	0.787	0.837	0.862	0.857	0.857	0.888	0.938	0.812	0.819	0.871	0.630	0.877	0.863	0.728	0.832	0.835	0.799	0.857	1.000	0.643	0.813	0.815
SVM - linear	0.545	0.657	0.731	0.500	0.620	0.500	0.784	0.653	0.767	0.649	0.703	0.500	0.740	0.741	0.739	0.753	0.623	0.484	0.550	0.542	0.794	0.648	0.721	0.708	0.617	0.840	0.500	0.571	0.730	0.760
SVM - poly	0.690	0.682	0.917	0.696	0.865	0.863	0.728	0.877	0.813	0.841	0.857	0.879	0.778	0.753	0.857	0.891	0.724	0.909	0.788	0.842	0.863	0.810	0.855	0.938	0.722	0.824	0.927	0.774	0.857	0.798
SVM - rbf	0.545	0.632	0.731	0.500	0.653	0.500	0.811	0.676	0.813	0.649	0.699	0.752	0.716	0.786	0.780	0.782	0.623	0.484	0.577	0.585	0.763	0.673	0.732	0.667	0.572	0.752	0.500	0.571	0.730	0.760

Table 4.41 | Balanced accuracy score for 30 energy image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	1.000	1.000	0.981	0.967	1.000	0.974	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.925	0.938	0.927	0.946	1.000	0.931	0.947	1.000	1.000	1.000	0.983	1.000	0.824	0.835	0.982
Bernoulli Naive Bayes	0.940	0.912	0.838	0.827	0.955	0.964	0.972	0.933	0.885	0.971	0.941	0.807	1.000	0.967	0.920	0.887	0.958	0.615	0.732	0.848	0.652	0.917	0.886	0.980	0.729	0.879	0.782	0.505	0.817	0.742
Dummy Classifier	0.388	0.524	0.458	0.500	0.494	0.500	0.484	0.500	0.500	0.500	0.500	0.500	0.500	0.548	0.500	0.500	0.500	0.377	0.500	0.604	0.500	0.500	0.362	0.612	0.500	0.455	0.522	0.500	0.527	0.486
Extra Trees	0.583	0.500	0.889	0.500	0.967	0.500	0.946	0.967	0.981	0.941	0.853	0.500	0.929	0.977	0.923	0.828	0.671	0.500	0.500	0.786	0.500	0.974	0.533	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.917	1.000	0.947	1.000	1.000	1.000	0.944	1.000	1.000	1.000	0.941	1.000	1.000	0.977	0.962	0.950	0.938	0.927	0.946	0.978	0.931	0.972	1.000	0.980	1.000	0.912	0.964	0.895	0.918	0.927
Gradient Boosting	1.000	1.000	1.000	1.000	0.933	1.000	0.974	1.000	1.000	1.000	0.975	1.000	0.921	0.977	0.941	0.950	0.938	0.927	0.920	1.000	0.931	0.920	1.000	0.980	0.981	0.983	0.964	0.824	0.938	0.982
Helstrom Quantum Classifier	1.000	1.000	1.000	1.000	1.000	1.000	0.974	0.967	0.981	0.971	0.971	1.000	1.000	1.000	0.920	0.946	0.958	0.944	0.974	0.978	0.963	0.947	1.000	0.938	0.962	0.950	0.964	0.929	0.960	0.982
Linear Discriminant Analysis	0.960	1.000	0.921	1.000	1.000	0.929	0.972	0.933	0.923	0.971	0.941	0.983	0.976	0.967	0.917	0.887	0.920	0.927	0.762	0.891	0.844	0.944	0.909	0.958	1.000	0.967	0.964	0.769	0.920	0.982
Logistic Regression	1.000	1.000	0.974	1.000	1.000	0.929	1.000	0.967	0.962	0.971	0.941	1.000	1.000	0.977	0.941	0.900	0.958	0.927	0.946	0.978	0.931	0.918	1.000	0.958	0.981	0.983	0.964	0.895	0.940	0.982
Multi Layer Perceptron	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.967	0.962	1.000	0.941	1.000	1.000	0.977	0.941	0.946	0.958	0.927	0.946	0.978	0.931	0.893	1.000	0.958	0.981	0.983	0.964	0.879	0.918	0.982
Nearest Centroid	0.960	0.941	0.865	0.923	0.955	1.000	0.917	0.933	0.942	0.916	0.941	0.950	0.952	0.933	0.938	0.782	0.938	0.927	0.918	0.913	0.839	0.944	0.909	0.938	0.813	0.967	0.929	0.850	0.980	0.982
Nearest Neighbors	1.000	1.000	1.000	1.000	1.000	0.964	0.972	0.967	0.981	0.971	0.946	1.000	1.000	1.000	0.920	0.975	0.920	0.944	0.974	1.000	0.963	1.000	1.000	0.958	1.000	0.983	0.964	0.824	1.000	0.982
Passive Aggressive Classifier	1.000	1.000	0.947	0.981	1.000	1.000	0.972	0.967	1.000	0.900	0.912	1.000	1.000	0.977	0.941	0.946	0.766	0.927	0.946	0.978	0.931	0.974	0.932	0.958	1.000	0.983	0.964	0.900	0.960	0.982
Perceptron	1.000	1.000	0.947	0.981	0.967	0.964	0.918	0.967	0.909	1.000	0.941	0.929	1.000	1.000	0.885	0.875	0.899	0.927	0.946	1.000	0.931	0.918	0.977	0.958	0.981	0.983	0.946	0.917	0.877	0.982
Quadratic Discriminant Analysis	0.917	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.981	1.000	0.941	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.974	0.978	0.931	1.000	1.000	0.980	0.935	0.983	0.964	0.895	0.898	0.927
Random Forest	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	1.000	1.000	0.975	1.000	1.000	0.977	0.962	0.925	0.938	0.871	0.946	1.000	0.931	0.893	1.000	1.000	0.981	0.983	1.000	0.824	0.938	0.982
SVM - linear	1.000	1.000	1.000	1.000	1.000	0.964	1.000	0.967	0.981	1.000	0.971	1.000	1.000	1.000	0.962	0.946	0.958	0.927	0.946	1.000	0.931	0.974	1.000	0.958	1.000	0.983	0.964	0.895	0.940	0.982
SVM - poly	1.000	1.000	1.000	1.000	1.000	0.964	0.974	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.920	0.946	0.938	0.927	0.946	1.000	0.931	0.921	1.000	0.958	0.981	0.983	0.982	0.912	0.918	0.982
SVM - rbf	1.000	1.000	1.000	1.000	1.000	1.000	0.974	0.967	0.981	1.000	0.971	1.000	1.000	1.000	0.962	0.946	0.958	0.927	0.946	1.000	0.931	0.974	1.000	0.980	1.000	0.983	0.964	0.895	0.940	0.982

Table 4.42 | Balanced accuracy score for 30 homogeneity image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.975	1.000	0.952	0.955	0.962	0.950	0.958	0.927	0.946	0.978	0.931	0.974	1.000	0.980	1.000	0.983	0.982	0.862	0.917	0.982
Bernoulli Naive Bayes	1.000	1.000	1.000	1.000	1.000	0.978	0.974	1.000	1.000	1.000	0.975	0.983	1.000	1.000	0.962	0.946	0.917	0.909	0.972	1.000	0.926	0.974	1.000	0.980	0.962	0.983	0.946	0.681	0.960	0.982
Dummy Classifier	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.329	0.510	0.500	0.707	0.500	0.500	0.659	0.565	0.623	0.542	0.462	0.396	0.415	0.500	0.500	0.500	0.500	0.564	0.500	0.471	0.527	0.490
Extra Trees	0.958	1.000	1.000	0.818	0.967	0.679	0.974	0.933	1.000	1.000	0.971	0.857	0.952	0.977	0.962	0.946	0.938	0.889	0.500	1.000	0.750	0.974	0.967	0.500	0.818	0.500	1.000	0.500	0.792	0.889
Gaussian Naive Bayes	1.000	1.000	1.000	1.000	0.967	0.978	0.974	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.946	1.000	0.950	0.974	1.000	0.980	1.000	0.983	0.982	0.895	0.938	0.982
Gradient Boosting	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	0.981	1.000	0.946	1.000	0.976	1.000	0.941	0.950	0.920	0.927	0.946	0.978	0.931	0.892	1.000	1.000	1.000	0.983	0.964	0.862	0.980	0.982
Helstrom Quantum Classifier	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.975	0.896	0.927	0.946	1.000	0.950	0.974	1.000	0.980	1.000	0.983	0.982	0.895	0.980	0.982
Linear Discriminant Analysis	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.946	0.917	0.927	0.972	1.000	0.931	0.974	1.000	1.000	1.000	0.983	0.982	0.840	0.918	0.982
Logistic Regression	1.000	1.000	0.974	1.000	0.967	1.000	0.974	1.000	0.981	1.000	1.000	1.000	1.000	1.000	0.962	0.975	0.938	0.927	0.946	0.978	0.950	0.974	1.000	1.000	1.000	0.983	0.982	0.862	0.918	0.982
Multi Layer Perceptron	1.000	1.000	0.947	1.000	1.000	1.000	0.974	0.967	0.981	1.000	0.971	1.000	1.000	0.977	0.962	0.921	0.878	0.927	0.946	0.978	0.931	0.974	1.000	1.000	1.000	0.983	0.982	0.895	0.897	0.982
Nearest Centroid	1.000	1.000	0.974	1.000	1.000	1.000	0.974	0.967	1.000	0.946	0.975	1.000	0.976	1.000	0.938	0.871	0.917	0.927	0.946	1.000	0.913	0.946	0.977	1.000	1.000	0.983	0.964	0.862	0.980	0.982
Nearest Neighbors	1.000	1.000	1.000	1.000	0.967	0.978	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.950	0.899	0.927	0.972	1.000	0.931	0.974	1.000	0.980	1.000	0.983	0.982	0.912	0.877	0.982
Passive Aggressive Classifier	1.000	1.000	0.814	1.000	0.933	0.978	0.972	0.967	1.000	1.000	0.975	1.000	0.976	0.955	0.941	0.950	0.864	0.927	0.972	1.000	0.931	0.946	1.000	1.000	1.000	0.983	0.929	0.879	0.898	0.982
Perceptron	1.000	1.000	0.974	1.000	0.967	0.978	1.000	1.000	0.962	1.000	0.971	1.000	0.929	0.977	0.864	0.900	0.804	0.927	0.946	0.893	0.931	0.868	1.000	1.000	1.000	0.983	0.964	0.807	0.940	0.982
Quadratic Discriminant Analysis	1.000	1.000	1.000	1.000	0.967	0.978	1.000	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.946	1.000	0.950	0.974	1.000	1.000	1.000	0.983	0.982	0.895	0.918	0.982
Random Forest	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.971	1.000	1.000	0.977	0.962	0.900	0.958	0.927	0.946	0.978	0.950	0.947	1.000	1.000	1.000	1.000	0.982	0.862	0.938	0.982
SVM - linear	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	1.000	1.000	1.000	0.977	0.962	0.946	0.958	0.927	0.972	1.000	0.950	0.974	0.977	1.000	1.000	0.983	0.982	0.840	0.897	0.982
SVM - poly	1.000	1.000	0.972	1.000	0.977	1.000	0.946	1.000	1.000	1.000	1.000	1.000	1.000	0.977	0.962	0.950	0.938	0.927	0.974	1.000	0.950	1.000	1.000	0.958	1.000	0.983	0.982	0.912	0.958	0.982
SVM - rbf	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.962	0.975	0.958	0.927	0.946	1.000	0.950	0.974	0.977	1.000	1.000	0.983	0.982	0.840	0.958	0.982

Table 4.43 | AUROC score for 30 RGB image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.917	0.950	0.944	0.955	0.933	0.943	0.921	0.955	0.981	1.000	0.900	0.929	0.921	0.832	0.923	0.896	0.917	0.927	0.893	0.964	0.900	0.893	1.000	0.938	0.916	0.912	0.964	0.786	0.833	0.871
Bernoulli Naive Bayes	0.917	0.875	0.944	0.955	0.933	0.913	0.895	0.886	0.955	0.866	0.825	0.929	0.906	0.932	0.923	0.846	0.854	0.927	0.867	0.857	0.850	0.868	0.921	0.858	0.955	0.840	0.946	0.757	0.833	0.871
Dummy Classifier	0.500	0.440	0.500	0.500	0.500	0.635	0.377	0.494	0.500	0.599	0.500	0.471	0.500	0.482	0.540	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.494	0.590	0.500	0.367	0.500	0.500	0.500	0.500
Extra Trees	0.917	0.875	0.889	0.955	0.900	0.957	0.893	0.876	0.909	0.857	0.950	0.929	0.762	0.921	0.885	0.871	0.822	0.833	0.500	0.857	0.700	0.895	0.967	0.833	0.500	0.714	0.500	0.500	0.500	0.778
Gaussian Naive Bayes	0.897	0.925	0.944	0.935	0.967	0.957	0.895	0.955	0.935	1.000	0.900	0.929	0.945	0.921	0.923	0.871	0.896	0.927	0.841	0.857	0.850	0.947	0.921	0.938	0.955	0.824	0.944	0.769	0.792	0.871
Gradient Boosting	0.917	0.950	1.000	0.955	0.977	0.978	0.947	0.921	0.981	1.000	0.887	0.929	0.897	0.944	0.902	0.896	0.896	0.927	0.893	0.964	0.831	0.946	0.977	0.938	0.955	0.912	0.929	0.769	0.835	0.853
Helstrom Quantum Classifier	0.917	0.950	0.944	0.955	0.833	0.935	0.895	0.909	1.000	0.950	0.925	0.929	0.906	0.955	0.923	0.900	0.819	0.889	0.789	0.929	0.850	0.842	0.967	0.920	0.909	0.840	0.944	0.752	0.813	0.871
Linear Discriminant Analysis	0.917	0.875	0.861	0.955	0.867	0.935	0.947	0.932	0.981	0.925	0.841	0.929	0.906	0.955	0.923	0.900	0.816	0.889	0.842	0.800	0.800	0.947	0.967	0.960	0.955	0.786	0.944	0.786	0.792	0.815
Logistic Regression	0.917	0.950	0.944	0.955	0.933	0.978	0.947	0.932	0.962	0.975	0.866	0.929	0.897	0.955	0.923	0.871	0.837	0.891	0.893	0.871	0.831	0.921	0.967	0.938	0.955	0.840	0.964	0.786	0.833	0.871
Multi Layer Perceptron	0.917	0.950	0.972	0.955	0.933	0.978	0.920	0.955	1.000	1.000	0.946	0.929	0.897	0.921	0.923	0.871	0.854	0.891	0.867	0.943	0.931	0.921	0.932	0.938	0.897	0.840	0.964	0.786	0.878	0.909
Nearest Neighbors	0.917	0.925	0.944	0.955	0.967	0.943	0.921	0.932	1.000	0.975	0.900	0.929	0.882	0.955	0.923	0.900	0.798	0.889	0.921	0.929	0.850	0.921	1.000	0.980	0.909	0.840	0.889	0.786	0.875	0.871
Quadratic Discriminant Analysis	0.897	0.975	0.972	0.935	0.967	0.978	0.974	0.898	0.962	0.971	0.925	0.929	0.921	0.977	0.902	0.871	0.875	0.909	0.893	0.893	0.831	0.947	1.000	0.980	0.955	0.840	0.982	0.786	0.833	0.927
Random Forest	0.917	0.925	0.972	0.955	0.944	0.943	0.947	0.955	0.962	1.000	0.925	0.929	0.921	0.977	0.923	0.896	0.896	0.927	0.893	0.929	0.831	0.946	1.000	0.938	0.955	0.840	0.929	0.786	0.813	0.871
SVM - linear	0.917	0.950	0.944	0.955	0.967	0.957	0.921	0.932	1.000	0.975	0.896	0.929	0.945	0.955	0.923	0.871	0.854	0.927	0.895	0.871	0.850	0.921	0.967	0.980	0.909	0.840	0.944	0.786	0.833	0.871
SVM - poly	0.917	0.921	0.889	0.909	0.900	0.943	0.921	0.955	0.727	1.000	0.871	0.929	0.969	0.855	0.923	0.871	0.854	0.889	0.842	0.964	0.850	0.947	0.967	0.980	0.890	0.840	0.964	0.769	0.792	0.871
SVM - rbf	0.917	0.950	0.583	0.955	0.933	0.978	0.947	0.909	1.000	0.975	0.896	0.929	0.945	0.955	0.923	0.871	0.500	0.927	0.842	0.536	0.850	0.921	0.600	0.980	0.500	0.714	0.944	0.786	0.833	0.871

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.44 | AUROC score for 30 L*u*v* image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.917	0.950	0.972	0.909	0.933	0.943	0.920	0.888	0.981	0.971	0.891	0.929	0.921	0.888	0.923	0.841	0.896	0.927	0.893	0.943	0.831	0.921	0.967	0.938	0.916	0.895	0.964	0.769	0.815	0.871
Bernoulli Naive Bayes	0.897	0.900	0.944	0.955	0.967	0.913	0.895	0.909	0.955	0.900	0.900	0.929	0.906	0.955	0.923	0.846	0.854	0.927	0.865	0.893	0.850	0.895	0.967	0.900	0.955	0.912	0.909	0.786	0.813	0.871
Dummy Classifier	0.500	0.500	0.500	0.500	0.483	0.491	0.459	0.500	0.500	0.606	0.500	0.500	0.500	0.448	0.500	0.500	0.421	0.500	0.500	0.467	0.409	0.433	0.406	0.550	0.514	0.636	0.413	0.531	0.500	0.484
Extra Trees	0.875	0.875	0.861	0.818	0.833	0.978	0.895	0.921	0.955	0.916	0.900	0.929	0.747	0.955	0.885	0.871	0.896	0.833	0.737	0.857	0.850	0.895	0.967	0.500	0.773	0.769	0.833	0.500	0.792	0.871
Gaussian Naive Bayes	0.897	0.950	0.944	0.955	0.900	0.978	0.947	0.932	0.935	0.946	0.900	0.929	0.890	0.977	0.902	0.841	0.875	0.927	0.893	0.893	0.831	0.947	1.000	0.980	0.955	0.824	0.927	0.786	0.833	0.871
Gradient Boosting	0.877	0.925	1.000	0.935	0.967	0.943	0.920	0.888	0.962	0.971	0.891	0.929	0.897	0.911	0.902	0.866	0.857	0.909	0.892	0.921	0.831	0.892	0.977	0.897	0.916	0.895	0.929	0.786	0.835	0.853
Helstrom Quantum Classifier	0.917	0.900	0.972	0.955	0.867	0.935	0.921	0.932	0.955	0.950	0.875	0.929	0.906	0.977	0.923	0.871	0.816	0.889	0.895	0.893	0.850	0.921	1.000	0.980	0.909	0.769	0.964	0.824	0.833	0.871
Linear Discriminant Analysis	0.917	0.900	0.861	0.955	0.867	0.935	0.947	0.932	0.955	0.950	0.841	0.929	0.906	0.955	0.923	0.900	0.854	0.889	0.868	0.871	0.850	0.947	0.967	0.960	0.955	0.840	0.944	0.786	0.833	0.871
Logistic Regression	0.897	0.950	0.944	0.955	0.967	0.978	0.947	0.921	0.981	0.950	0.896	0.929	0.874	0.955	0.923	0.871	0.896	0.891	0.867	0.885	0.881	0.947	0.967	0.938	0.955	0.840	0.982	0.786	0.875	0.871
Multi Layer Perceptron	0.897	0.950	1.000	0.955	0.967	0.921	0.947	0.932	0.981	0.971	0.900	0.929	0.850	0.977	0.923	0.871	0.875	0.891	0.867	1.000	0.831	0.947	0.932	0.938	0.955	0.895	0.927	0.786	0.857	0.871
Nearest Neighbors	0.917	0.900	0.944	0.955	0.900	0.943	0.921	0.898	1.000	0.950	0.925	0.929	0.906	0.888	0.920	0.871	0.816	0.889	0.868	0.893	0.850	0.867	1.000	0.938	0.955	0.840	1.000	0.786	0.875	0.871
Quadratic Discriminant Analysis	0.897	0.975	0.972	0.955	0.967	0.943	0.974	0.932	0.942	0.971	0.896	0.929	0.921	0.977	0.902	0.871	0.875	0.909	0.893	0.907	0.850	0.947	1.000	0.980	0.955	0.840	0.982	0.786	0.833	0.927
Random Forest	0.917	0.925	1.000	0.955	1.000	0.943	0.920	0.921	0.981	1.000	0.891	0.929	0.945	0.944	0.923	0.896	0.896	0.927	0.893	0.929	0.831	0.920	1.000	0.980	0.955	0.895	0.929	0.786	0.855	0.871
SVM - linear	0.897	0.950	0.944	0.955	0.900	0.957	0.947	0.932	0.955	0.950	0.925	0.929	0.890	0.955	0.923	0.871	0.875	0.889	0.895	0.871	0.850	0.921	0.967	0.938	0.955	0.840	0.944	0.786	0.792	0.871
SVM - poly	0.917	0.875	0.917	0.955	0.867	0.943	0.947	0.932	0.955	0.950	0.900	0.929	0.890	0.955	0.902	0.871	0.798	0.889	0.842	0.978	0.850	0.895	1.000	0.980	0.955	0.714	0.927	0.786	0.833	0.871
SVM - rbf	0.897	0.900	0.667	0.955	0.900	0.978	0.947	0.932	0.955	0.925	0.825	0.929	0.945	0.955	0.923	0.871	0.875	0.871	0.500	0.893	0.850	0.895	0.567	0.980	0.500	0.500	0.927	0.786	0.833	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.45 | AUROC score for 30 contrast image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	0.971	1.000	0.981	0.933	0.978	1.000	0.967	0.962	1.000	0.975	1.000	1.000	0.967	1.000	0.975	0.979	0.927	0.972	0.957	0.950	0.918	0.977	0.958	1.000	0.983	0.889	0.983	0.938	0.982
Bernoulli Naive Bayes	0.958	0.946	0.974	1.000	0.900	0.826	0.974	0.886	0.981	0.950	0.900	1.000	0.906	0.886	0.962	0.900	0.920	0.909	0.946	0.929	0.950	0.947	0.944	0.735	1.000	0.983	0.964	0.967	0.897	0.982
Dummy Classifier	0.385	0.500	0.500	0.612	0.552	0.500	0.405	0.492	0.406	0.500	0.347	0.500	0.500	0.517	0.588	0.500	0.500	0.653	0.500	0.500	0.500	0.513	0.500	0.548	0.500	0.460	0.500	0.500	0.500	0.500
Extra Trees	0.708	0.825	0.806	0.500	0.667	0.500	1.000	0.944	0.962	0.882	0.500	0.500	0.500	0.932	0.692	0.828	0.538	0.500	0.500	0.821	0.500	0.808	0.677	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	1.000	0.971	0.974	1.000	0.967	1.000	1.000	0.944	0.962	0.971	0.975	1.000	1.000	0.911	1.000	0.975	0.979	0.909	0.972	0.929	0.981	0.974	0.977	0.960	1.000	0.983	0.964	0.950	0.875	0.982
Gradient Boosting	1.000	0.971	1.000	0.981	0.944	0.978	1.000	0.898	0.935	1.000	0.975	1.000	0.976	0.944	1.000	0.925	1.000	0.927	0.920	0.957	0.950	0.946	0.977	0.958	1.000	0.983	0.889	0.967	0.938	0.982
Helstrom Quantum Classifier	1.000	0.971	1.000	0.955	0.933	0.978	1.000	0.898	0.981	1.000	0.925	1.000	0.938	0.955	1.000	0.950	0.938	0.927	0.737	0.929	0.750	0.947	0.977	0.980	1.000	0.983	0.944	0.983	0.875	0.982
Linear Discriminant Analysis	0.958	0.921	0.946	0.955	0.867	0.978	0.974	0.921	0.981	1.000	0.950	0.929	0.938	0.932	0.962	0.900	0.938	0.871	0.893	0.893	0.900	0.947	0.911	0.980	0.909	0.912	0.889	0.643	0.875	0.815
Logistic Regression	1.000	0.946	0.974	1.000	0.933	0.978	1.000	0.944	0.962	1.000	0.950	0.929	1.000	0.921	1.000	0.950	0.979	0.927	0.972	0.929	0.950	0.947	0.944	0.980	1.000	0.983	0.944	0.967	0.875	0.982
Multi Layer Perceptron	1.000	0.946	1.000	1.000	0.933	0.978	1.000	0.898	0.962	1.000	0.950	0.929	1.000	0.967	1.000	0.925	0.979	0.927	0.972	0.957	1.000	0.947	0.977	0.980	0.981	0.983	0.944	0.967	0.855	0.982
Nearest Neighbors	1.000	0.971	1.000	1.000	0.967	0.907	1.000	0.921	0.981	1.000	0.950	1.000	1.000	0.888	0.962	0.975	0.958	0.927	1.000	0.964	0.950	0.974	0.977	0.938	1.000	0.983	1.000	0.857	0.875	0.982
Quadratic Discriminant Analysis	1.000	0.971	0.974	1.000	0.967	1.000	1.000	0.944	0.962	0.971	0.975	1.000	1.000	0.911	1.000	0.975	0.979	0.927	0.972	0.964	0.981	0.974	0.977	0.980	1.000	0.983	0.964	0.967	0.875	0.982
Random Forest	1.000	0.971	1.000	1.000	1.000	0.978	1.000	0.921	0.962	1.000	0.975	1.000	1.000	0.933	1.000	0.975	0.979	0.927	0.972	1.000	0.950	0.947	0.977	0.958	1.000	0.983	0.944	0.967	0.938	0.982
SVM - linear	1.000	0.971	0.974	1.000	0.933	0.978	1.000	0.898	0.962	1.000	0.950	1.000	1.000	0.911	0.962	0.975	0.958	0.909	0.946	0.964	0.950	0.947	0.944	0.960	1.000	0.983	0.944	0.967	0.897	0.982
SVM - poly	1.000	0.971	0.974	1.000	0.933	1.000	1.000	0.921	0.962	1.000	0.975	1.000	0.938	0.944	1.000	0.975	0.958	0.927	0.946	0.929	0.950	0.947	0.944	0.938	1.000	0.983	0.944	0.950	0.875	0.667
SVM - rbf	0.500	0.500	0.500	1.000	0.967	0.978	1.000	0.944	0.962	1.000	0.950	0.500	1.000	0.911	0.962	0.925	0.958	0.500	0.500	0.964	0.500	0.974	0.500	0.980	0.818	0.500	0.500	0.643	0.855	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.46 | AUROC score for 30 correlation image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	0.608	0.816	0.759	0.500	0.830	0.607	0.756	0.811	0.839	0.812	0.803	0.752	0.778	0.820	0.700	0.703	0.801	0.744	0.759	0.820	0.700	0.700	0.653	0.750	0.572	0.840	0.909	0.521	0.710	0.871
Bernoulli Naive Bayes	0.528	0.657	0.754	0.500	0.562	0.500	0.838	0.608	0.858	0.565	0.665	0.840	0.676	0.797	0.665	0.574	0.763	0.556	0.548	0.592	0.681	0.620	0.655	0.672	0.689	0.736	0.500	0.450	0.753	0.669
Dummy Classifier	0.447	0.500	0.500	0.521	0.500	0.500	0.405	0.500	0.621	0.500	0.500	0.526	0.653	0.500	0.502	0.500	0.500	0.377	0.500	0.500	0.500	0.405	0.500	0.500	0.500	0.493	0.500	0.500	0.488	0.617
Extra Trees	0.500	0.500	0.611	0.500	0.567	0.500	0.784	0.721	0.871	0.651	0.500	0.500	0.500	0.558	0.591	0.576	0.538	0.500	0.500	0.500	0.500	0.753	0.533	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.523	0.607	0.731	0.526	0.742	0.693	0.811	0.686	0.813	0.703	0.732	0.752	0.723	0.718	0.739	0.703	0.739	0.502	0.577	0.635	0.813	0.730	0.755	0.732	0.591	0.769	0.760	0.643	0.730	0.760
Gradient Boosting	0.733	0.841	0.917	0.734	0.842	0.921	0.782	0.855	0.904	0.837	0.803	0.929	0.778	0.865	0.878	0.866	0.798	0.891	0.788	0.856	0.794	0.835	0.730	0.897	0.864	0.786	0.871	0.769	0.710	0.815
Helstrom Quantum Classifier	0.525	0.657	0.836	0.677	0.721	0.728	0.864	0.776	0.755	0.871	0.846	0.950	0.802	0.855	0.857	0.791	0.753	0.891	0.784	0.899	0.863	0.756	0.844	0.710	0.825	0.912	0.871	0.643	0.733	0.909
Linear Discriminant Analysis	0.545	0.657	0.731	0.526	0.620	0.585	0.728	0.653	0.767	0.649	0.694	0.786	0.771	0.741	0.700	0.728	0.662	0.484	0.550	0.542	0.794	0.649	0.709	0.648	0.617	0.840	0.722	0.643	0.710	0.760
Logistic Regression	0.545	0.657	0.731	0.526	0.620	0.585	0.728	0.653	0.767	0.649	0.694	0.786	0.795	0.741	0.721	0.753	0.662	0.484	0.550	0.542	0.794	0.649	0.709	0.648	0.617	0.840	0.722	0.643	0.710	0.760
Multi Layer Perceptron	0.772	0.678	0.917	0.825	0.832	0.849	0.754	0.755	0.813	0.896	0.887	0.983	0.874	0.865	0.917	0.841	0.780	0.982	0.813	0.842	0.744	0.807	0.855	0.877	0.591	0.840	0.964	0.648	0.730	0.964
Nearest Neighbors	0.693	0.707	0.892	0.708	0.798	0.849	0.864	0.777	0.851	0.812	0.887	0.895	0.874	0.832	0.881	0.841	0.795	0.780	0.867	0.863	0.863	0.759	0.865	0.857	0.773	0.840	0.944	0.752	0.730	0.835
Quadratic Discriminant Analysis	0.483	0.599	0.782	0.526	0.709	0.728	0.784	0.698	0.767	0.753	0.732	0.857	0.795	0.774	0.760	0.703	0.756	0.593	0.604	0.679	0.826	0.703	0.755	0.752	0.636	0.752	0.742	0.610	0.730	0.760
Random Forest	0.710	0.791	0.889	0.682	0.921	0.893	0.892	0.832	0.787	0.837	0.916	0.857	0.881	0.888	0.958	0.862	0.840	0.909	0.709	0.877	0.863	0.728	0.798	0.835	0.734	0.857	0.982	0.714	0.813	0.815
SVM - linear	0.545	0.657	0.703	0.500	0.653	0.500	0.784	0.653	0.767	0.649	0.694	0.500	0.740	0.741	0.739	0.728	0.623	0.484	0.550	0.542	0.763	0.648	0.721	0.708	0.617	0.840	0.500	0.500	0.730	0.760
SVM - poly	0.690	0.741	0.917	0.696	0.809	0.764	0.728	0.721	0.813	0.841	0.857	0.895	0.778	0.753	0.857	0.891	0.724	0.909	0.788	0.957	0.763	0.810	0.821	0.938	0.545	0.769	0.927	0.719	0.752	0.853
SVM - rbf	0.545	0.632	0.731	0.500	0.720	0.500	0.811	0.500	0.813	0.649	0.500	0.752	0.716	0.500	0.780	0.500	0.500	0.520	0.500	0.585	0.794	0.673	0.732	0.667	0.572	0.752	0.500	0.571	0.730	0.760

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.47 | AUROC score for 30 energy image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	1.000	1.000	0.981	0.967	1.000	0.974	1.000	1.000	0.971	0.975	1.000	1.000	0.977	0.941	0.925	0.938	0.927	0.946	1.000	0.931	0.947	1.000	1.000	1.000	0.983	1.000	0.824	0.835	0.982
Bernoulli Naive Bayes	0.940	0.912	0.838	0.827	0.955	0.964	0.972	0.933	0.885	0.971	0.941	0.807	1.000	0.967	0.920	0.887	0.958	0.615	0.732	0.848	0.652	0.917	0.886	0.980	0.729	0.879	0.782	0.505	0.817	0.742
Dummy Classifier	0.508	0.419	0.500	0.463	0.518	0.500	0.349	0.562	0.500	0.594	0.500	0.500	0.589	0.505	0.500	0.599	0.519	0.540	0.466	0.500	0.533	0.500	0.473	0.447	0.500	0.500	0.613	0.400	0.500	0.500
Extra Trees	0.792	0.500	0.500	0.500	0.800	0.500	0.918	0.967	0.935	0.882	0.765	0.500	0.762	0.977	0.769	0.799	0.748	0.667	0.500	0.929	0.500	0.974	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
Gaussian Naive Bayes	0.917	1.000	0.947	1.000	1.000	1.000	0.944	1.000	1.000	1.000	0.941	1.000	1.000	0.977	0.962	0.950	0.938	0.927	0.946	0.978	0.931	0.972	1.000	0.980	1.000	0.912	0.964	0.895	0.918	0.927
Gradient Boosting	1.000	1.000	1.000	0.981	0.967	1.000	0.974	1.000	1.000	1.000	0.971	1.000	0.921	0.977	0.941	0.950	0.938	0.927	0.920	1.000	0.931	0.920	1.000	0.980	1.000	0.983	0.964	0.824	0.918	0.982
Helstrom Quantum Classifier	0.917	1.000	1.000	0.981	1.000	0.964	0.974	0.967	0.962	0.971	0.971	0.983	1.000	1.000	0.920	0.946	0.958	0.927	1.000	0.978	0.944	0.974	1.000	0.980	0.962	0.983	0.964	0.862	0.960	0.927
Linear Discriminant Analysis	0.960	1.000	0.921	1.000	1.000	0.929	0.972	0.933	0.923	0.971	0.941	0.983	0.976	0.967	0.917	0.887	0.920	0.927	0.762	0.891	0.844	0.944	0.909	0.958	1.000	0.967	0.964	0.769	0.920	0.982
Logistic Regression	1.000	1.000	0.974	0.981	1.000	0.929	1.000	0.967	0.942	0.971	0.941	1.000	1.000	1.000	0.941	0.946	0.958	0.927	0.946	0.957	0.931	0.918	1.000	0.958	0.981	0.983	0.964	0.824	0.940	0.982
Multi Layer Perceptron	1.000	1.000	1.000	0.981	1.000	0.929	0.974	0.967	0.942	0.971	0.971	1.000	1.000	0.977	0.938	0.916	0.958	0.927	0.946	0.957	0.931	0.921	1.000	0.958	1.000	0.983	0.964	0.857	0.918	0.982
Nearest Neighbors	1.000	1.000	1.000	1.000	1.000	0.964	0.972	0.967	0.981	1.000	0.946	1.000	1.000	1.000	0.920	0.946	0.920	0.944	0.974	1.000	0.963	1.000	0.977	0.958	1.000	0.983	0.964	0.824	0.980	0.982
Quadratic Discriminant Analysis	0.917	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.981	1.000	0.941	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.974	0.978	0.931	1.000	1.000	0.980	0.935	0.983	0.964	0.895	0.898	0.927
Random Forest	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	1.000	1.000	0.971	1.000	1.000	0.977	0.962	0.950	0.938	0.927	0.946	1.000	0.931	0.920	1.000	1.000	0.981	0.983	1.000	0.824	0.938	0.982
SVM - linear	1.000	1.000	1.000	1.000	1.000	0.964	1.000	0.967	0.962	1.000	0.971	1.000	1.000	1.000	0.962	0.946	0.958	0.927	0.946	0.957	0.931	0.974	1.000	0.958	1.000	0.983	0.964	0.895	0.898	0.982
SVM - poly	1.000	1.000	1.000	1.000	1.000	0.929	0.974	0.967	0.962	0.971	0.946	1.000	1.000	0.977	0.962	0.946	0.938	0.927	0.974	1.000	0.931	0.974	1.000	0.958	1.000	0.983	0.964	0.879	0.938	0.982
SVM - rbf	1.000	1.000	1.000	1.000	1.000	0.500	1.000	0.867	0.885	0.971	0.500	1.000	0.952	1.000	0.958	0.946	0.958	0.500	0.946	0.935	0.931	0.974	1.000	0.500	1.000	0.983	0.500	0.895	0.940	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

Table 4.48 | AUROC score for 30 homogeneity image feature datasets for cell line U251

Classifiers	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30
AdaBoost	1.000	1.000	1.000	1.000	1.000	1.000	0.974	1.000	1.000	1.000	1.000	1.000	0.976	0.955	0.962	0.950	0.958	0.927	0.946	0.957	0.931	0.974	1.000	1.000	1.000	0.983	0.982	0.845	0.938	0.982
Bernoulli Naive Bayes	1.000	1.000	1.000	1.000	1.000	0.978	0.974	1.000	1.000	1.000	0.975	0.983	1.000	1.000	0.962	0.946	0.917	0.909	0.972	1.000	0.926	0.974	1.000	0.980	0.962	0.983	0.946	0.681	0.960	0.982
Dummy Classifier	0.428	0.500	0.500	0.500	0.495	0.533	0.542	0.550	0.500	0.485	0.500	0.500	0.542	0.338	0.571	0.500	0.500	0.669	0.572	0.500	0.470	0.500	0.500	0.610	0.500	0.500	0.522	0.471	0.530	0.500
Extra Trees	0.833	1.000	0.972	0.727	0.967	0.857	0.890	0.967	1.000	1.000	0.912	0.786	0.786	0.977	0.962	0.921	0.938	0.722	0.500	1.000	0.750	0.974	0.900	0.917	0.682	0.500	0.778	0.500	0.583	0.833
Gaussian Naive Bayes	1.000	1.000	1.000	1.000	0.967	0.978	0.974	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.946	1.000	0.950	0.974	1.000	0.980	1.000	0.983	0.982	0.895	0.938	0.982
Gradient Boosting	1.000	1.000	0.974	1.000	0.967	1.000	0.918	1.000	0.981	1.000	0.975	1.000	1.000	0.977	0.941	0.950	0.920	0.927	0.946	0.957	0.931	0.920	0.977	1.000	1.000	0.983	0.964	0.862	0.980	0.982
Helstrom Quantum Classifier	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.946	0.917	0.927	0.972	1.000	0.950	0.974	1.000	0.980	1.000	0.983	0.982	0.912	0.938	0.982
Linear Discriminant Analysis	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.946	0.917	0.927	0.972	1.000	0.931	0.974	1.000	1.000	1.000	0.983	0.982	0.840	0.918	0.982
Logistic Regression	1.000	1.000	0.974	1.000	0.967	1.000	0.974	1.000	0.981	1.000	1.000	1.000	1.000	1.000	0.962	0.975	0.938	0.927	0.946	0.978	0.950	0.974	1.000	1.000	1.000	0.983	0.982	0.840	0.918	0.982
Multi Layer Perceptron	1.000	1.000	1.000	1.000	0.967	1.000	1.000	0.967	0.981	1.000	1.000	1.000	1.000	0.977	0.962	0.946	0.878	0.927	0.946	0.978	0.931	0.974	1.000	1.000	1.000	0.983	0.982	0.840	0.897	0.982
Nearest Neighbors	1.000	1.000	1.000	1.000	0.967	0.978	0.974	1.000	1.000	1.000	0.975	1.000	1.000	1.000	0.962	0.950	0.896	0.927	0.946	1.000	0.950	0.974	1.000	0.980	1.000	0.983	0.982	0.912	1.000	0.982
Quadratic Discriminant Analysis	1.000	1.000	1.000	1.000	0.967	0.978	1.000	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.950	0.958	0.927	0.946	1.000	0.950	0.974	1.000	1.000	1.000	0.983	0.982	0.895	0.918	0.982
Random Forest	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	0.946	1.000	1.000	0.977	0.962	0.950	0.958	0.871	0.946	0.978	0.950	0.947	1.000	1.000	1.000	0.983	0.982	0.862	0.938	0.982
SVM - linear	1.000	1.000	1.000	1.000	0.967	1.000	0.974	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.962	0.946	0.917	0.927	0.972	1.000	0.950	0.974	1.000	1.000	1.000	0.983	0.982	0.840	0.958	0.982
SVM - poly	0.833	0.950	1.000	0.955	0.967	1.000	0.974	1.000	1.000	1.000	1.000	1.000	1.000	0.977	0.885	0.946	0.938	0.927	0.946	0.913	0.950	0.947	1.000	1.000	1.000	0.983	0.982	0.857	0.875	0.833
SVM - rbf	0.500	0.500	1.000	1.000	1.000	1.000	0.974	1.000	1.000	0.500	1.000	0.500	1.000	0.977	0.500	0.500	0.917	0.500	0.500	0.500	0.500	0.974	0.500	0.500	1.000	0.500	0.500	0.840	0.500	0.500

Results exclude Nearest Centroid, Passive Aggressive Classifier and Perceptron.

References

1. Haralick, R. M., Shanmugam, K. *et al.* Textural features for image classification. *IEEE Trans. Syst. Man Cybern.* **SMC-3**, 610–621, DOI: 10.1109/TSMC.1973.4309314 (1973).
2. Haralick, R. M. Statistical and structural approaches to texture. *Proc. IEEE* **67**, 786–804, DOI: 10.1109/PROC.1979.11328 (1979).
3. Rundo, L. *et al.* HaraliCU: GPU-powered Haralick feature extraction on medical images exploiting the full dynamics of gray-scale levels. In Malyshkin, V. (ed.) *Parallel Computing Technologies (PaCT)*, vol. 11657 of *LNCS*, 304–318, DOI: 978-3-030-25636-4_24 (Springer International Publishing, Cham, Switzerland, 2019).