Bin Ratio-Based Histogram Distances and their Application to Image Classification

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Abstract

Image representation in form of Histogram plays an important role in image classification, action and pattern recognition. Differences i.e. distances can be well identified and studied using a histogram plot. It is the representation in the graphical form of the plot of tonal distribution of digital image. It is the plot of pixels against tonal value. One can judge the tonal distribution in an image just by looking the Histogram plot. When it comes to the local Patches i.e. the distribution of local areas of image, Quantization of patches by sub-histogram is good approach. Histogram followed by sub-histogram and different distance classifier along with SVM gives good accuracy level. There are many modern technologies coming up like expert system classifier, ANN and DTC that maximize the accuracy level. The report will summarize the advance classification approaches that are used to improve accuracy levels.

Keywords--*SVM, DTC, Artificial Neural Network, Expert System Classifier.*

I. INTRODUCTION

The images of same type may have differences in the bins after histogram plot due to background distraction and also due to some foreground occlusions. Thus histograms plots are normalised. Normalisation adapts the large scale changes in the image. Normalization however may produce large changes in the differences between corresponding bins in these histograms which make it difficult to classify image.

Classification of image is a technique of assigning corresponding levels with respect to groups with many different features aiming at distinguishing multiple objects within an image. Different levels are called as classes. Different features like density, colour, shape, texture present in image divides image into several classes[1][2].

The image Histogram so obtained is equalized and Histogram matching is done to improve contrast of image, for the better view of the structures and also to increase the intensity level in the image.

II. RELATED WORK

As in previous work the distance measurements calculated by Euclidean gave only mean information of the image but no information regarding variance was portrayed. The chessboard distance transform can be obtained from a 3×3 square element, a cross shaped element gives the `city block' distance transform, and a disk shaped element gives the Euclidean distance transform, Euclidean distance transform works tremendously for the 2-dimensional plot, 3-dimensional images requires the much higher transform[6][7]. Though the problem was resolved using many other distance formulas like Mahalaobis and Jeffery distance measure but still the classification to the proper class was not done. The accuracy level for these distance classifier was minimal.SVM on other hand proves to give far better accuracy.

Example of images from the Oxford Flowers, one image per class.

Procedure below describes the algorithm:

- Identification of the right hyper plane (figure a)
- Classification of two classes (figure b)
- Find the hyper-plane which segregate two classes (figure c)
- Add new features $z = x^2 + y^2$ and plot the data points on x and axis (figure d)
- Linear hyper plane is drawn by SVM but for the non-Linear hyper plane kernel function separated the data (figure e)

SVM works really well with clear margin of separation. It is effective in high dimensional spaces and also effective in cases where number of dimensions is greater than the number of samples. It uses a chain of training points in the decision function called support vectors (support vectors are to be assumed based on parametric computations), so it is also memory efficient. The only problem with SVM is that it doesn't perform

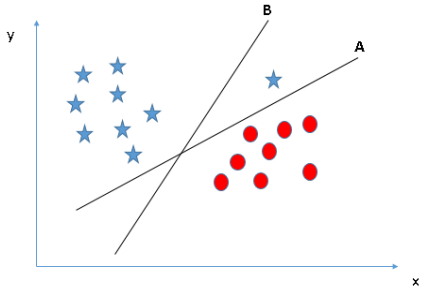


Figure a

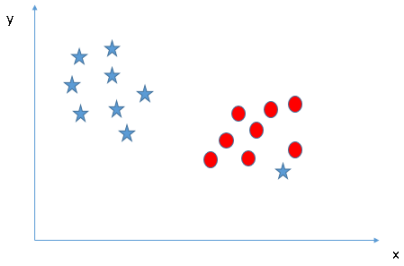


Figure b

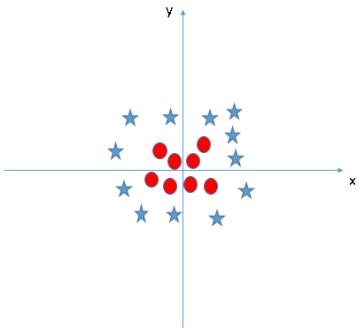


Figure c

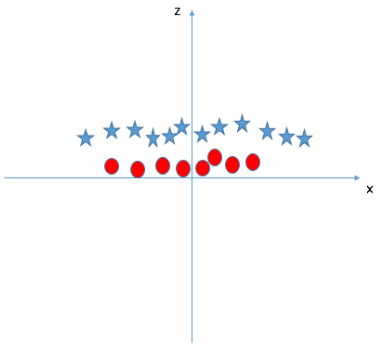


Figure d

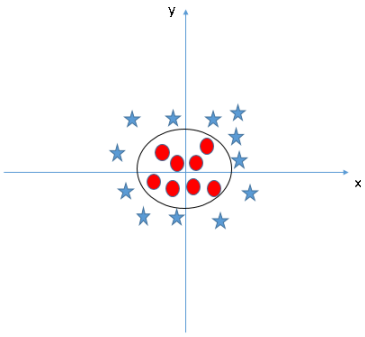
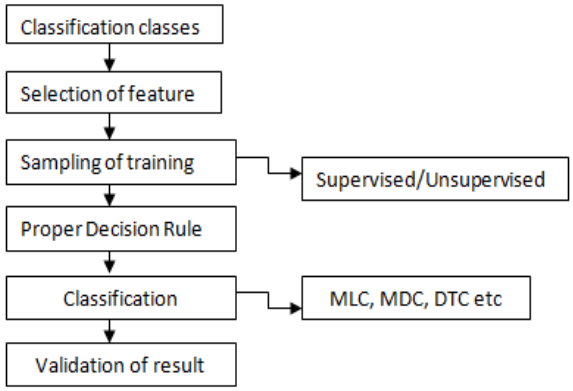


Figure e

well, when the available date set is large because the required training time is higher. SVM also doesn't perform very well, when the data set is having random noise i.e. when there are overlapping target classes. The training time in SVM can be reduced by some extent if we use appropriate kernel and regularisation hyper-parameters (i.e. linear kernel for linear problems and non-linear kernel for non-linear problems).[11]

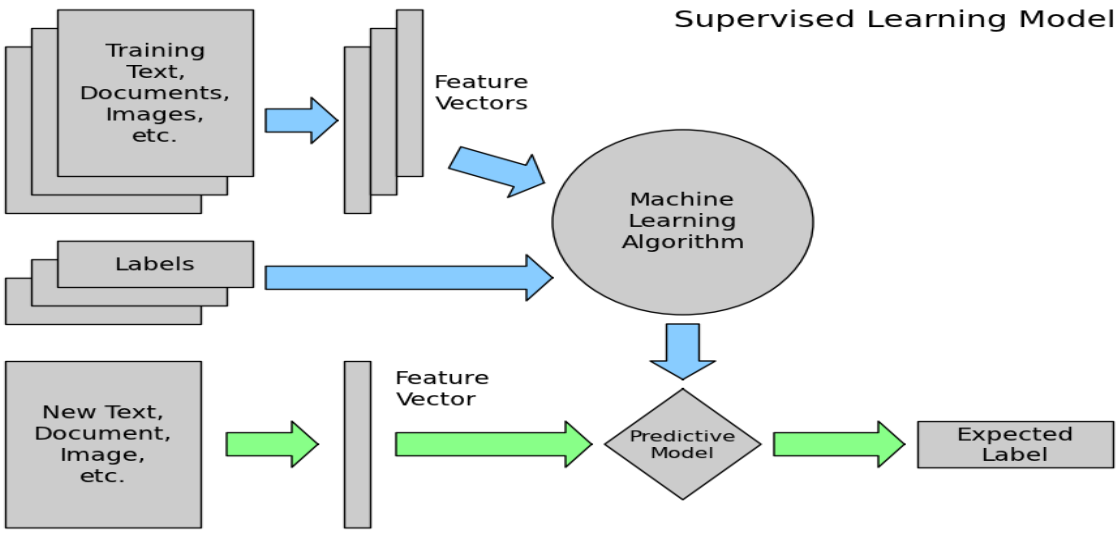
III.PROPOSED METHOD

The Flow chart explains the procedure of data classification



DTC is a hierarchical based classifier working on binary output i.e. it gives output only in two outcomes. It compares the data with the range of properly selected features.[10] The feature selection depends upon separability of class. There is no pre decided procedure thus each decision tree or set of rules should be determined by the expert beforehand. Generally group of classes is classified into two groups with respect to features. Features mostly used are i) Spectral values ii) Index computed by spectral value iii) Arithmetic value iv) Principle components. Computing time of DTC is less than compared to other classification methods.[3][4] DTC gives a very straightforward idea of solving problem of image classification.It poses a series of carefully crafted questions about the attributes of the test record.[5] Every time the system receives an answer, and a follow-up question is asked until it receives

conclusion about the class label of the record. The above method improves understanding of correspondence between automated extracted features for computerized automated identification (such as size, shape, colour, and texture



information). It also advances the integration of feature extraction.[8]

Test image undergoes through several steps which are elaborated in the form of a flow diagram above. Total 17 category, each category consist of 80 image (Few are detailed below). Thus 17 x 80 = 1360 image (40 Training, 20 Test, 20 Validation)[9]

IV. CONCLUSION

Three different Artificial intelligence techniques to classify the class were used i.e. Artificial neural network (ANN), support vector machine (SVM) and Decision tree classifier(DTC) were applied to classify image using optimal features obtained from cell segmented images. Results demonstrated that SVM along with Expert system classification had the highest classification rate of among all with very less time.[5][6] Applications requiring high computational efficiency can also use this approach. SVM is primarily set to maximize the margins, which guarantees that the input pattern would be classified correctly.ANN has bunch of hidden layers depending upon the number of features to be extracted. The computational time is more but use SVM along with ANN reduces the computational time and takes care about all the features extracted in an image for its classification.

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