



study; the algorithm detected more than 85 percent of the apples shown in the images below natural lighting ( Linker et al., 2012). Hence, the fruit classification(Sakib & Ashrafi, 1980),(Nosseir & Ashraf Ahmed, 2019),(Nayak, 2019),(Rocha et al., 2010) work is undertaken for the proposed work.

## Dataset

To carry out this experiment the dataset named as Fruit-360(Sakib & Ashrafi, 1980) has been used. The dataset contains many fruits images. Among all fruit images we have considered only Apple and Banana images. The 1k Apple fruit and 1k Banana images were taken. Following figure shows the sample input images.

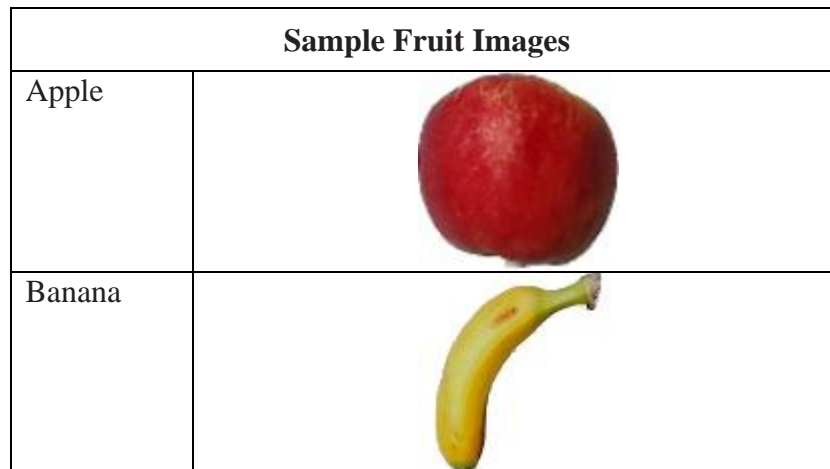


Figure 1: Sample input image

## Proposed method

This method have considered the shape features. The shape characteristics or visual characteristics are called visual features of objects. For instance, circular or triangular objects or other shapes, the object's perimeter boundary, the border diameter, and so on (Liu & Shi, 2011). The following algorithm shows the feature extraction and classification of Apple and Banana fruits.

Algorithm: Apple and Banana Fruit classification

Input: Fruit image

Output: Classified fruit

Start:

Step 1 : Read the input image

Step 2: Apply histogram equalization method on input image

Step 3: Convert RGB image into Grayscale image

Step 4: Convert Grayscale image into binary image.

Step 5: From binary image extract shape features (MajorAxisLength, MinorAxisLength Centroid, Eccentricity, EulerNumber, Orientation, Perimeter, Slidity)

Step 6: Store the extracted features in knowledge base alongwith its labels

Step 7: Set 5 fold cross-validation and apply the classifiers like (LDA, NB, Logistic Regression, SVM and KNN)

Step 8: Display the classified fruit

Stop.

## Experimental Result

To carry out the experiment the standard dataset named as fruit-360. Five popular classifiers are evaluated to obtain the classification accuracy. The following table shows the performance.

Table 1: Classification accuracy of five classifiers.

<b>Apple and Banana Classification Accuracy</b>			
<b>Sl. No.</b>	<b>Classifier</b>	<b>Rec.Acc.</b>	<b>Training Time in (Sec)</b>
1	LDA	85.00%	10.292
2	Naïve_Bays	87.00%	2.2948
3	Logistic_regression	93.60%	12.077
4	SVM	93.90%	4.766
5	KNN	<b>99.10%</b>	<b>2.2948</b>

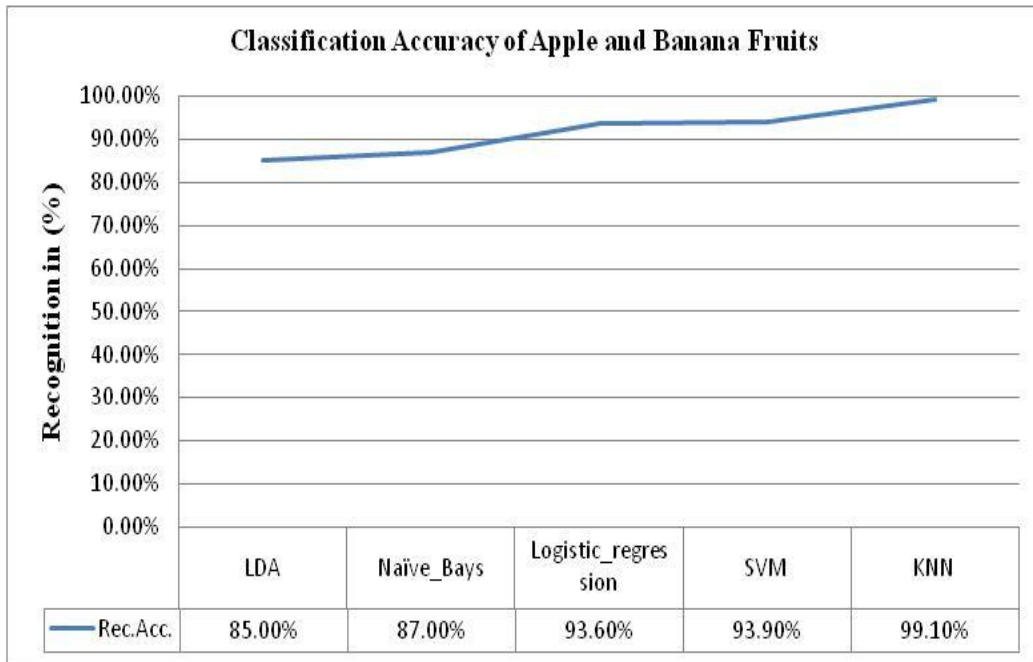


Figure 1: Performance of the classifiers over the shape features.

The below figures shows the individual performance of each classifiers over the shape features extracted from the Apple and Banana fruit.

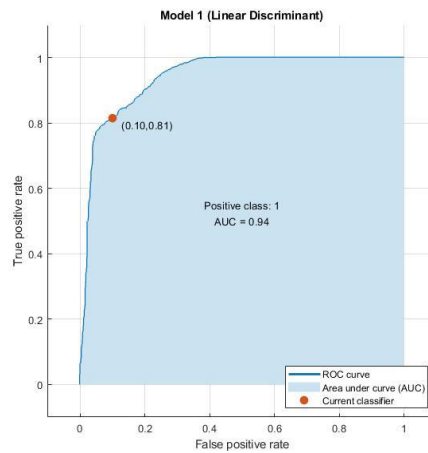


Figure 2: ROC of LDA Classifier.

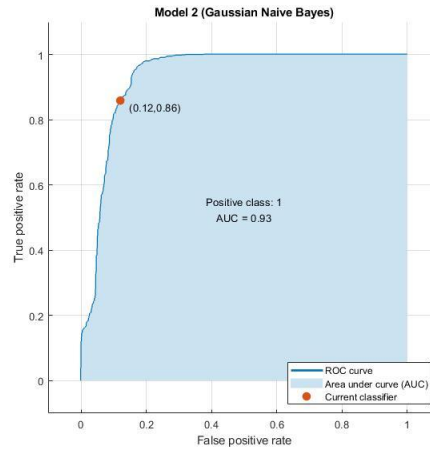


Figure 3: ROC of Naivebays classifier.

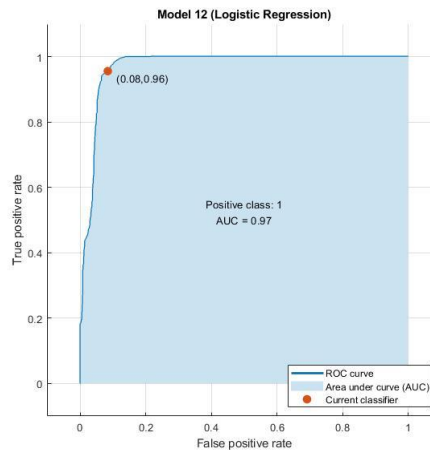


Figure 4: ROC for Logistic Regression

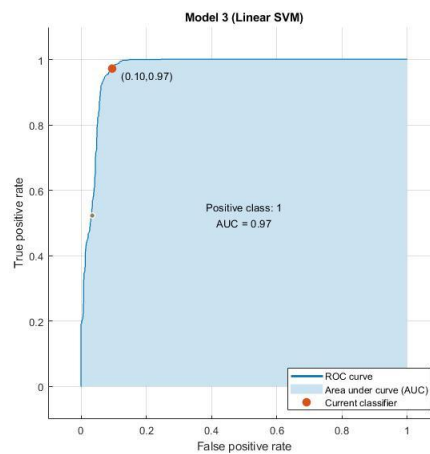


Figure 5: ROC for SVM

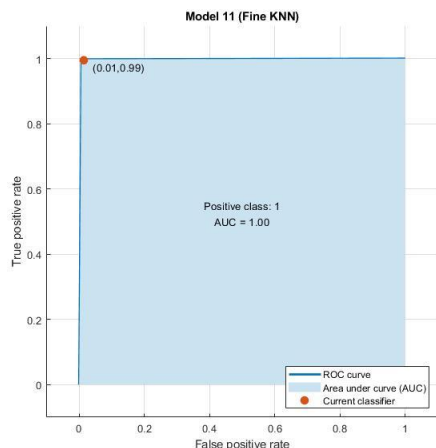


Figure 6: ROC for KNN Classifier

From the above table and graph it is clearly observed that the KNN classifier has outperformed from other classifiers.

## Conclusion

The classification of Apple and Banana fruit were carried out in this proposed method. The shape feature has used as the features. The five classifiers namely, LDA, Naïve bays, Logistic Regression, SVM and KNN. In the future work the other features will considered and those features should less in numbers and high in classification accuracy.

## References

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