Pattern Recognition
Assignment 2
Group No - 36

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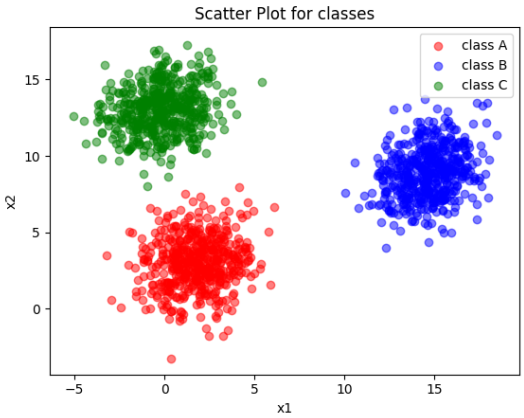
Contents

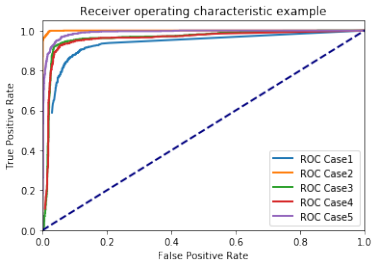
1 Introduction

We have three datasets to work with. One dataset is linearly seperable that means all the classes can be seperated using linear lines. Second dataset is Non-Linearly Seperable dataset that means we should get non linear decision boundaries between each class. Third dataset is Linearly Non Seperable dataset it means data cannot be seperated using linear lines.

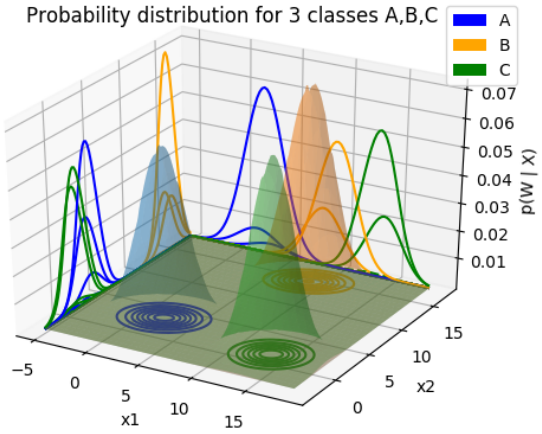
2 Linearly Separable Data-set



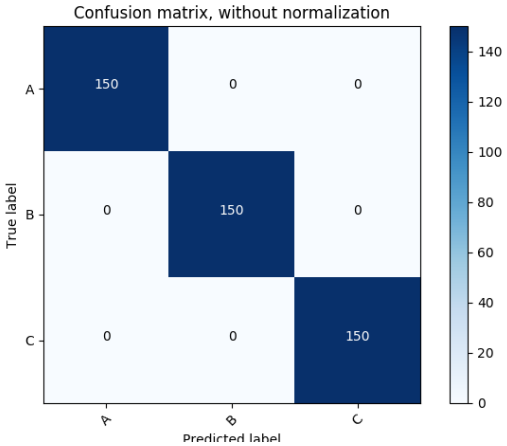
(a) Scatter Plot for each class



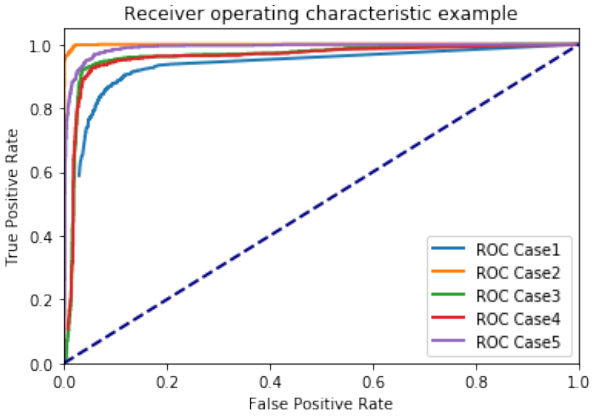
(b) Constant Density Curves and Decision Boundaries



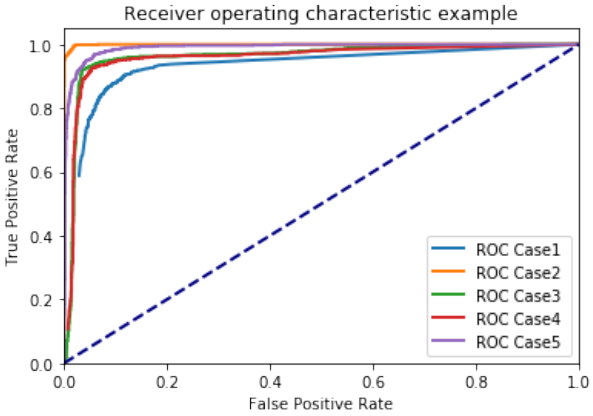
(c) Gaussian Distributions for each class and feature



(d) Confusion Matrix



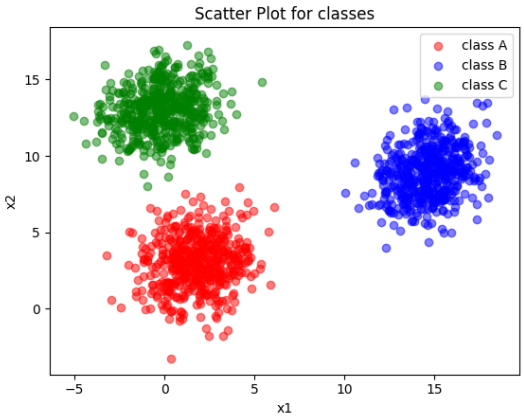
(e) ROC Curve



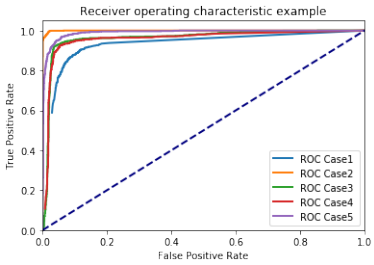
(f) DET Curve

Figure 1: Summary of Non Linearly Separable Dataset

3 Non-Linearly Separable Data-set



(a) Scatter Plot for each class



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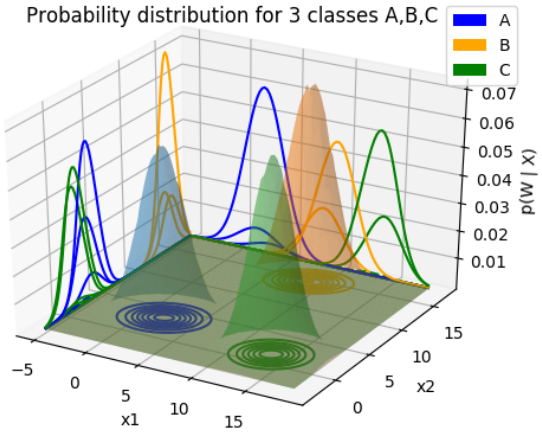

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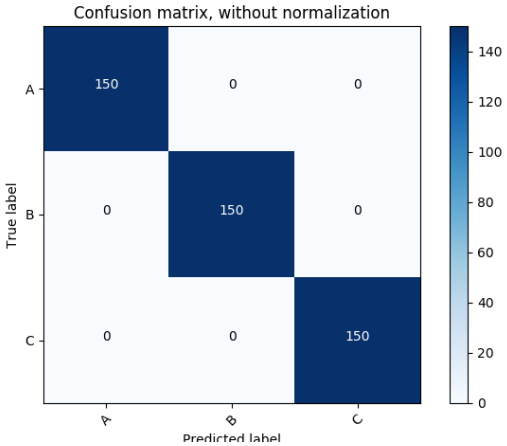

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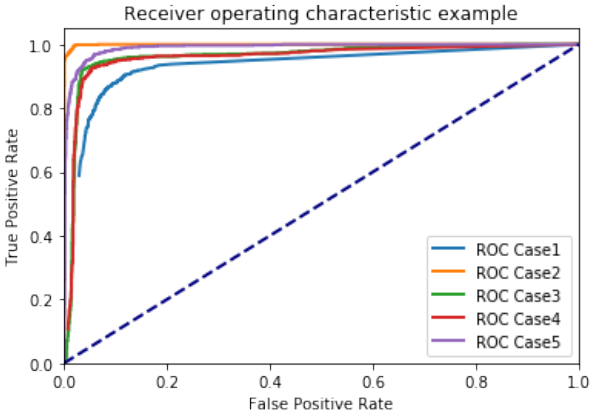
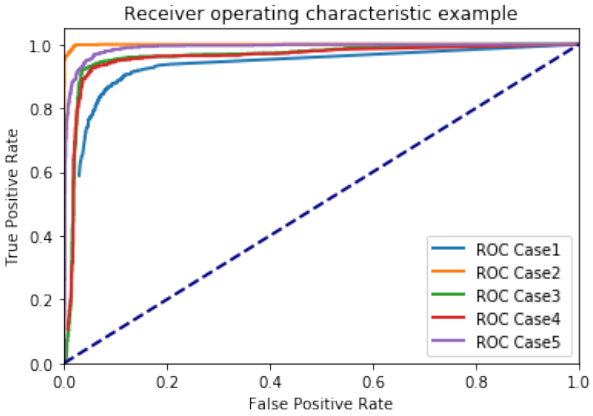


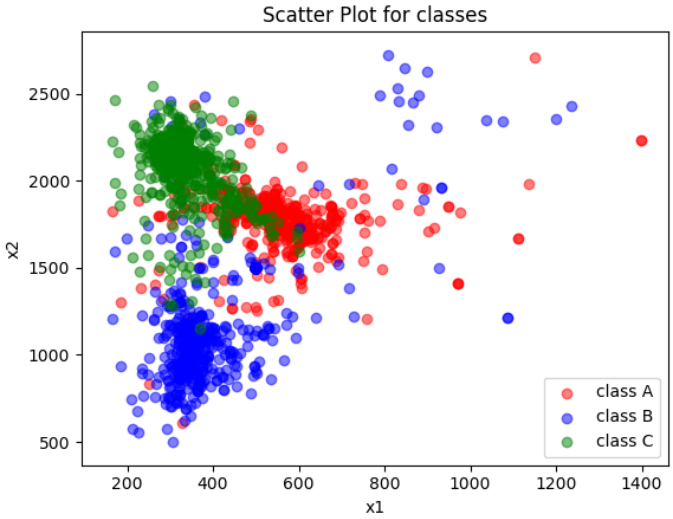
(e) ROC Curve



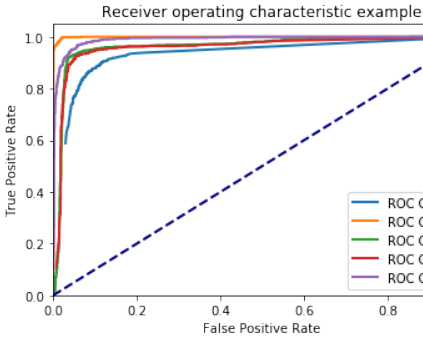
(f) DET Curve

Figure 2: Summary of Non Linearly Separable Dataset

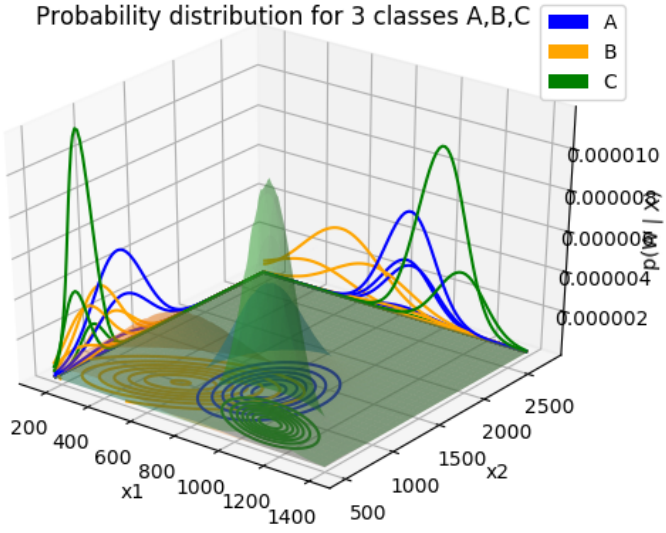
4 Linearly Non-Separable Data-set



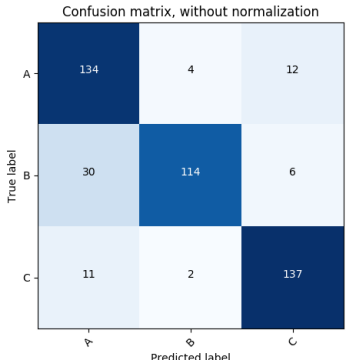
(a) Scatter Plot for each class



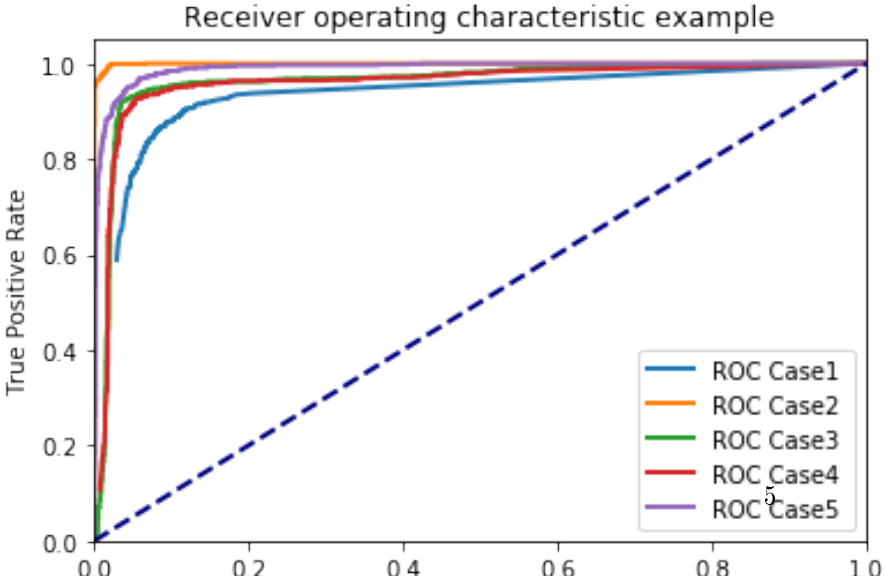
(b) Constant Density Curves and Decision

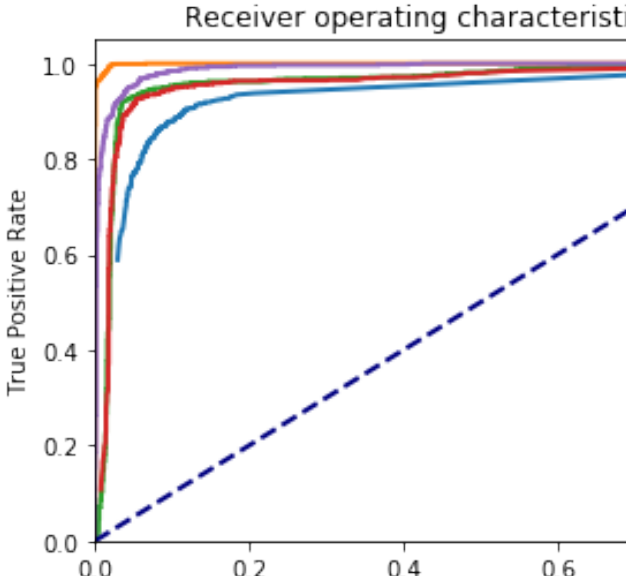


(c) Gaussian Distributions for each class and feature



(d) Confusion Matrix





5 Observations:

1) If the constant density curves are circles that means the covariance matrix for all the classes is same which is nothing but our case 1 and case 4. 2) Eigen vectors are perpendicular to the lines joining the means of each distribution in case 1 and case 4. 3) Whereas for other cases when covariance matrix for all the classes is different, the constant density curves are ellipsoids. 4) Eigen vectors of these hyper-ellipsoids shows the distribution of the data points along the principal axes of the ellipsoid. 5) If I move along the major axis or minor axis density goes on reducing or increasing depending on the case. 6) The decision boundaries are not perpendicular in case 2 and case 5. 7) The decision boundaries are not perpendicular in case 1. 8) The nature of the ROC and DET curves that we got match with the theory we studied in class. 9) The confusion matrix also justify the metrics. 10) For real data, all the points are not properly classified since decision boundaries are not ale to make distinction between all the three classes so accuracy and other metrics are not upto the mark in this case. 11) For linearly separable dataset and non-linearly separable dataset the accuracy is pretty high.