Machine Intelligence and Learning

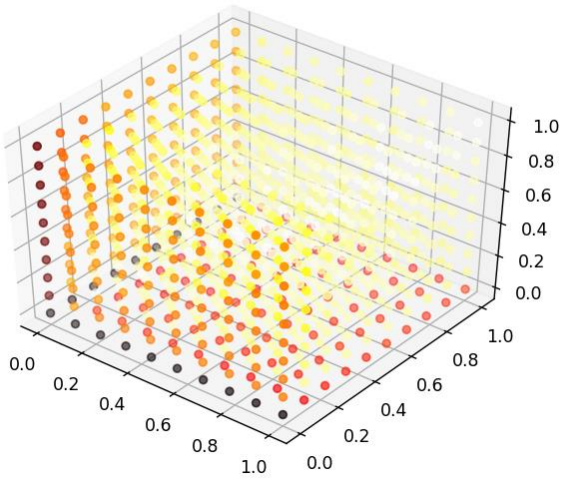
Indian Institute of Technology Delhi

COURSE ASSIGNMENT 2

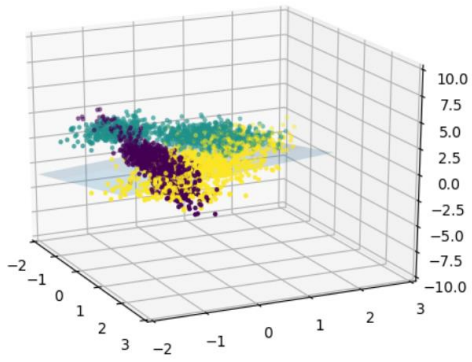
Mayank Mishra 2016EE30506 Chahat Chawla 2016MT10492

Medical Dataset

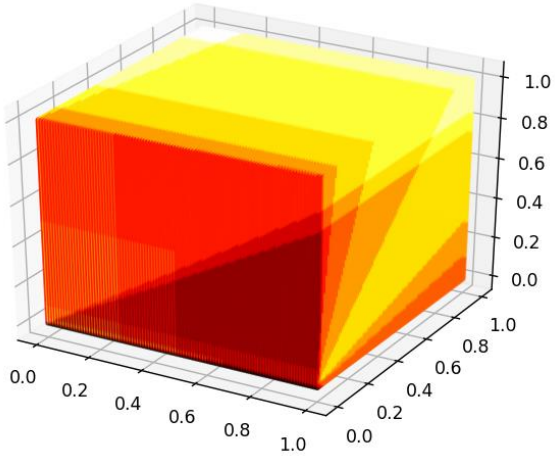
Visualizations



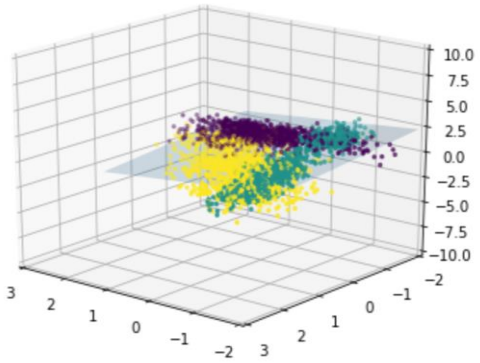
(a)



(a)

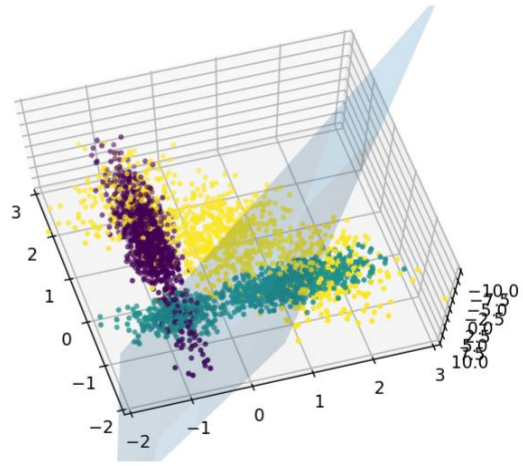


(b)



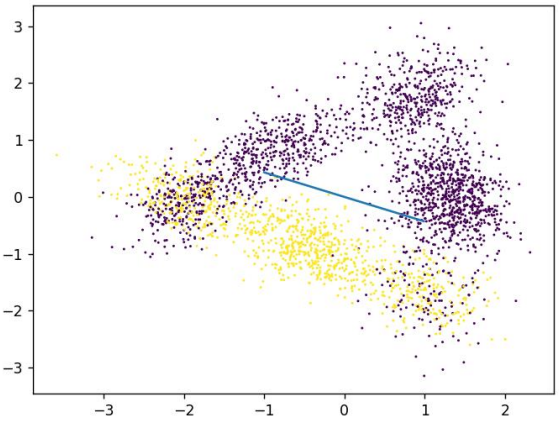
(b)

Fig. 1: Hyperparameter Tuning (Threshold vs Accuracy)
[Color indicates the accuracy for the three classes]



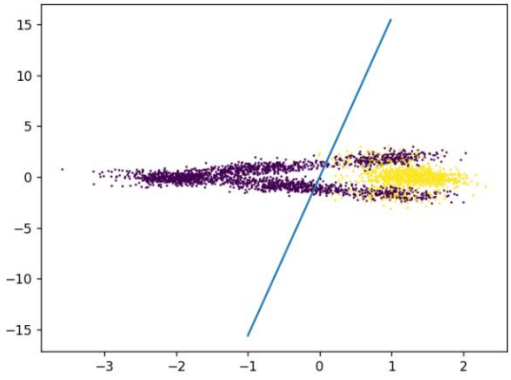
(c)

Fig. 2: Visualizing Hyperplanes learnt by Perceptron[(a) Medication (b) Healthy (c) Surgery]

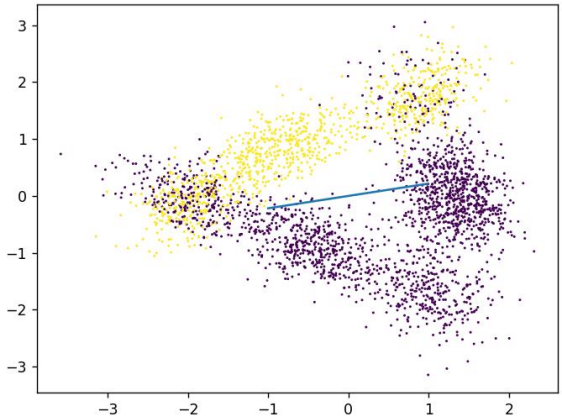


c)

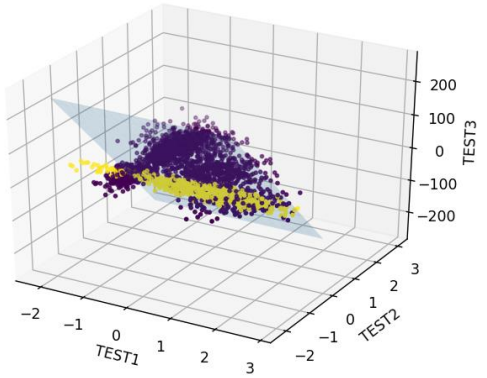
Fig. 3: Visualizing Hyperplanes learnt by Perceptron **with PCA** [(a) Medication (b) Healthy (c) Surgery]



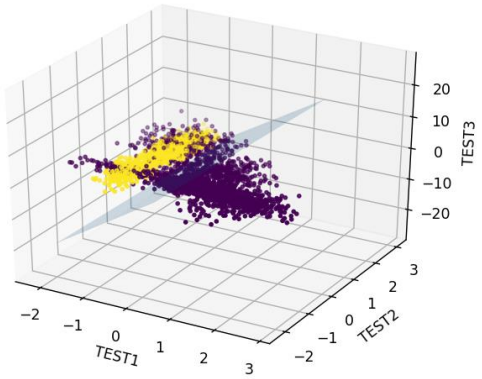
a)



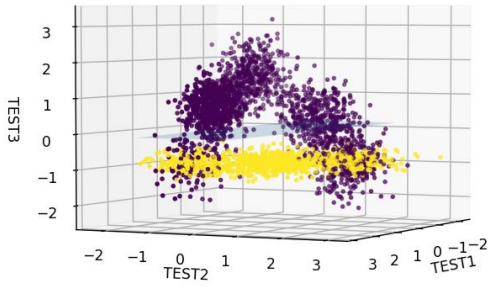
b)



a)



b)



c)

Fig. 4: One vs All Classification using FLDA [(a) Medication (b) Healthy (c) Surgery]

Algorithm	Accuracy
Logistic Regression (Without Regularization)	89.33%
Logistic Regression (With Regularization)	88.93%
Softmax Classifier	89.57%
Perceptron	59.23%
Perceptron (after PCA)	80.08%
SVM (Not Linearly Separable)	
FLDA (multiclass: healthy, surgery, medication)	77.56%, 81.67%, 80.77 %

Table 1: Accuracy with different algorithms

Railway Dataset

Algorithm	Accuracy
Logistic Regression (Without Regularization)	21.37%
Logistic Regression (With Regularization)	21.37%
Softmax Classifier	21.37%
Perceptron	59.93%
SVM (Linearly Separable Assumption)	59.93%
SVM (Not Linearly Separable)	77.67%
FLDA	50.00%

Table 2: Accuracy with different algorithms

Data Visualization

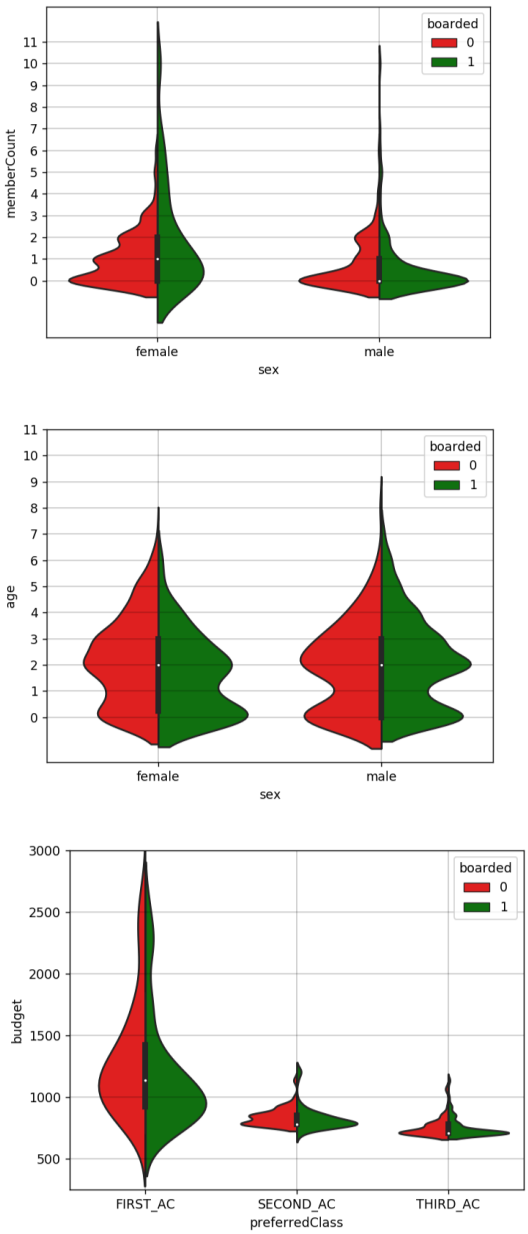


Fig. 5: Class Conditional Distribution of Features

Fashion MNIST Dataset

Algorithm	Accuracy
Logistic Regression (Without Regularization)	80.08%
Perceptron	63.15%

River Dataset

Data Visualization

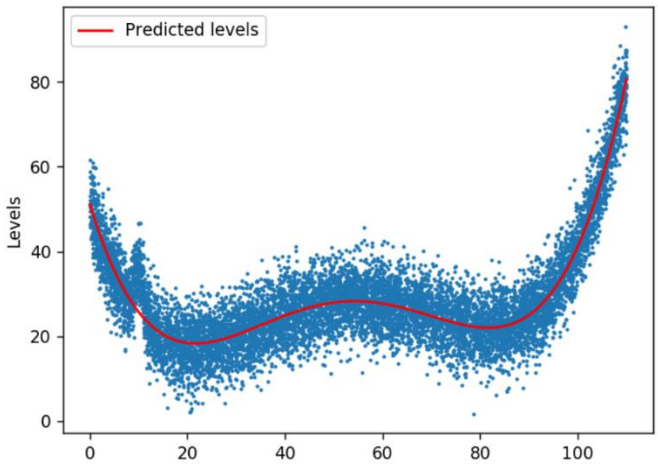


Fig.6: Original Data (in blue) and the predicted Curve (in Red)

Due to the nature of the problem, we apply Regression.

Learnings from the Assignment

- Gauging the performance of the algorithms designed for the linearly separable datasets on non-linearly separable datasets was one interesting aspect of the assignment.
- We apply transformation onto higher dimensional space to "improve linear separability" and thence aiding the learning of "better" separating hyperplanes.
- We learnt to make the optimal bias-variance tradeoff, by dividing the dataset into the Train/CV/Test Sets and tuning hyperparameters.
- Being a medical application, trading the different types of metrics (type-I, type-II errors) with medical dataset could be very much different. (An insight into the actual deployment of the Machine Learning models)
- We learnt to deal with Multiclass Classification tasks, via the One vs All and other approaches.
- Realized the significance of choosing the right Kernel for SVM. Specifically, we experimented with Polynomial, Gaussian, Sigmoidal, Laplace Kernels.
- We employed both the batch and stochastic versions of Perceptron and saw the difference while learning (due to Stochastic nature of the former) but to ultimate convergence.
- We employed 4-dimensional tensor to boost the performance of softmax classifier.

Implementation Details

- Local Optimums are attained with Softmax on Medical Dataset on different runs.
- Regularization did not help us in our case.
- We verified in working that Cross-Entropy Loss converges faster than Squared Error Loss.