MLFA LAB
Assignment - 3

Name: Aryan Satpathy

Roll: 20EC10014

Experiment 1

Plot of % Accuracy v/s Learning Rate on the validation set:
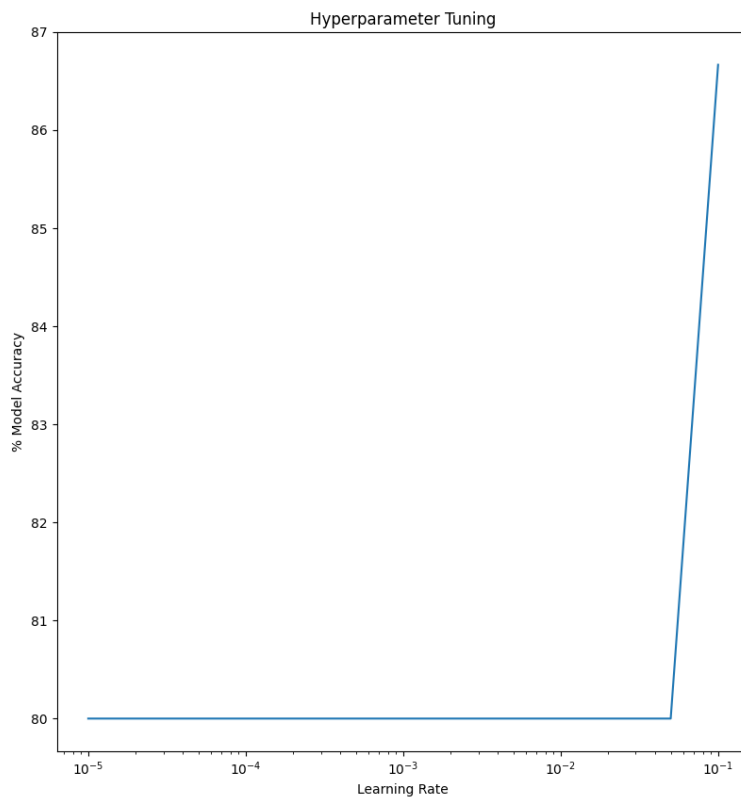

Figure 1: % Accuracy v/s Learning Rate

Remarks:

1. Best Learning Rate: 0.1
2. These results are **very specific to the seed** chosen. I changed my seed and got 0.05 as the best Learning Rate. This is because the validation set is very small and might end up containing data of only one class due to a certain **unfortunate seed**.

Experiment 2

Plot of Probabilities v/s Epochs on train set(separated based on class):

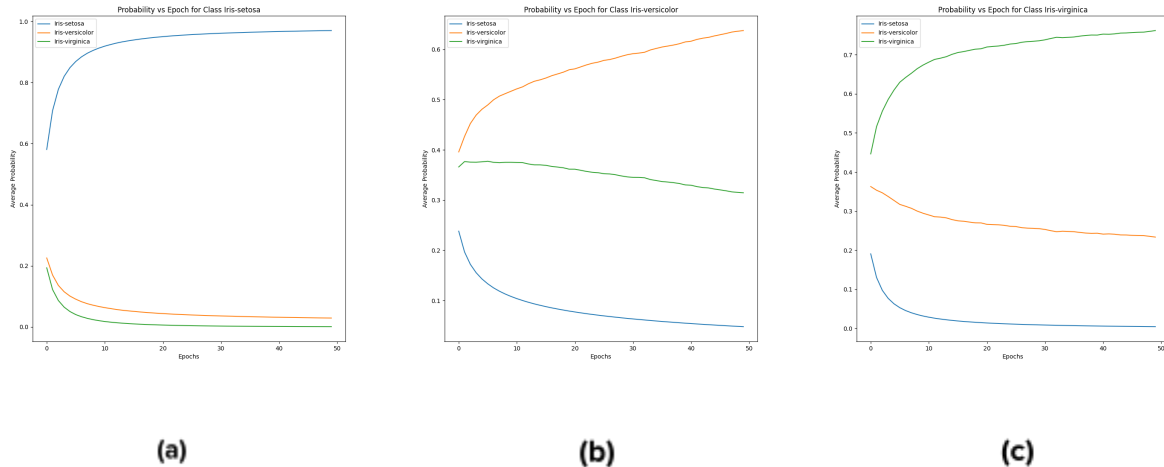(a)   (b)   (c)

Figure 2: Average Probabilities v/s Epochs

Remarks:

1. The model learns to classify **Iris - Setosa** really well. However, it struggles with **Iris - Versicolor** as the model confuses its features with that **Iris - Virginica**. This effect is also visible in the plot for **Iris - Virginica**.

2. My understanding behind this phenomenon, is that the data might look something like this:

   Green might be **very concentrated** and a lot of its portion lies near somewhat **dense regions of Blue**. This will lead to **wrong predictions of** those **Green** samples. Whereas **Blue** is rather **spread out** and its **prediction will not suffer** as much as green will. Amidst all this, **Red** will be **perfectly separable**(also noticed as **accuracy = 1** in next experiment).
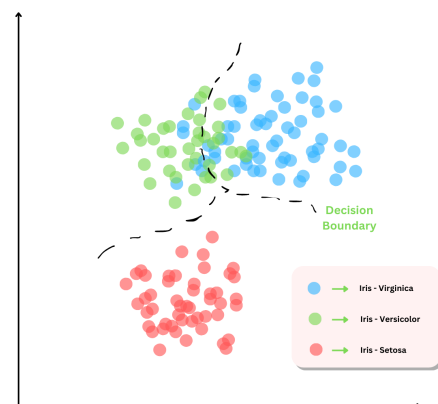

Figure 3: Visualization

Experiment 3

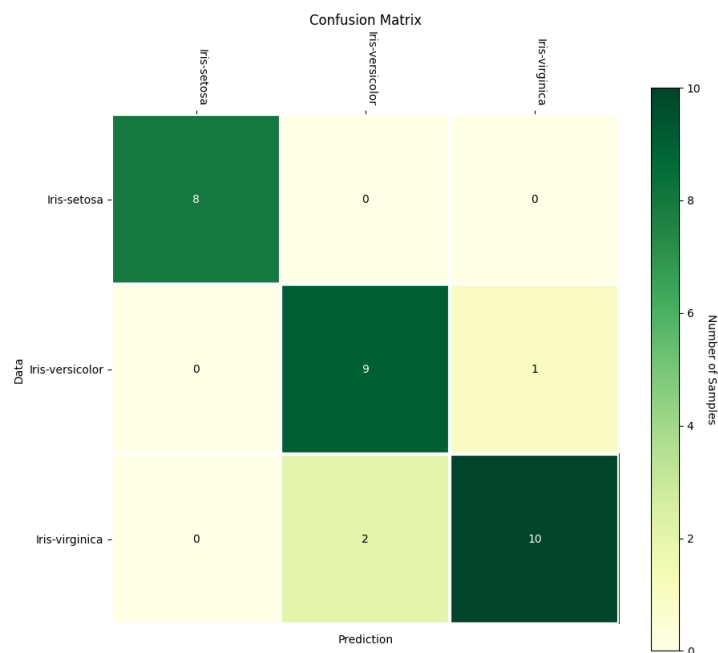**Heatmap of Confusion Matrix** on test data:

Figure 4: Confusion Matrix

Confusion Matrix in tabular form:

Class	Iris - Setosa	Iris - Versicolor	Iris - Virginica
Iris - Setosa	8	0	0
Iris - Versicolor	0	9	1
Iris - Virginica	0	2	10

Table 1: Confusion Matrix in Tabular Form

(Row represents Data and Column represents Prediction)

Performance Metrics on the test data are as follows:

Class	Precision	Recall	F1
Iris - Setosa	1.00	1.00	1.00
Iris - Versicolor	0.82	0.90	0.86
Iris - Virginica	0.91	0.83	0.87

Table 2: Performance Metrics on test data

Observation and remarks about the results:

1. **Iris - Setosa** is **perfectly separable**. This can be concluded from the fact that **precision** and **recall** are **1**.

2. **Iris - Versicolor** has a relatively bad classification score. The model confuses **Iris - Versicolor** with **Iris - Virginica**. This could be because of the explanation I provided in **Experiment 2 Figure-3**. We also notice this in the **Average Probability v/s Epochs** graph. Notice how the **prediction probability** for **Iris - Virginica** **increases at first**, followed by steady dropping(**Figure 2 b**).

3. **Iris - Virginica** has a relatively **better performance** than that of **Iris - Versicolor**, however it's **not perfect**(like that of **Iris - Setosa**). I have tried to explain this in **Experiment 2 Figure-3**.