Question 1: - 2 Marks

- Visualize 5 samples from each class in the form of images.

  (0.5 Marks)

- Apply LDA(use sklearn) on the given dataset.

  (0.5 Marks)

- Report accuracy and class-wise accuracy for testing dataset.

(Overall accuracy - 0.5 Marks , classwise accuracy - 0.5 marks(only classwise accuracy allowed not classification report))

(the difference between our accuracy and student's accuracy should be +/- 10% otherwise reduce 0.25 marks for each case)

Our accuracy :

```
Accuracy Score :  37.13
```

Our classwise accuracy :

```
Accuracy for class name : airplane , is : accuracy :  46.300000000000004
Accuracy for class name : automobile , is : accuracy :  41.5
Accuracy for class name : bird , is : accuracy :  25.5
Accuracy for class name : cat , is : accuracy :  24.5
Accuracy for class name : deer , is : accuracy :  27.1
Accuracy for class name : dog , is : accuracy :  32.9
Accuracy for class name : frog , is : accuracy :  41.3
Accuracy for class name : horse , is : accuracy :  40.400000000000006
Accuracy for class name : ship , is : accuracy :  49.4
Accuracy for class name : truck , is : accuracy :  42.4
```

Question 2 - (2 Marks)

- Apply PCA(use sklearn) on the given data and set the hyperparameter n components = 15.
- Apply LDA(use sklearn) on the transformed data.
- Repeat step-1 and step-2 by keeping n components = 8 and 3.

Apply PCA only on training set.(+ 0.5 marks)

Accuracy for first experiment, 2nd experiment and 3nd experiment (0.25 Marks +0.25 Marks+0.25 marks)

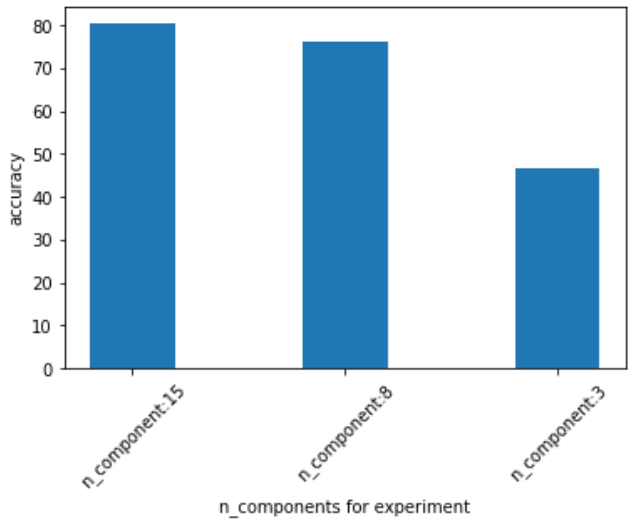
- Plot accuracy of all three experiments on testing dataset and report which experiments give better result and why?.

Plot accuracy for each experiment and report which experiment is better and why(0.25 marks + 0.5 marks)

(the difference between our accuracy and student's accuracy should be +/- 10% otherwise reduce 0.25 marks for each case)

Our accuracy :

```
experiment where n_components = 15, and achieved accuracy : 80.39
experiment where n_components = 8, and achieved accuracy : 76.05
experiment where n_components = 3, and achieved accuracy : 46.6
```



Question - 3(2 Marks)

- **Implement FDA on given data for multiple classes from scratch, and find the coefficient vector W.(Note: computation of W will use training samples only.)**

(+0.5 marks)[Follow the approach defined in code)

- **Calculate mean for each class**
- **Calculate global mean**
- **Calculate scatter matrix within classes**
- **Calculate scatter matrix between classes**
- **Calculate Eigenvalue and vector and sort decreasing order based on Eigen value**
- **Select top c-1 Eigenvalue and corresponding Eigenvector.**
- **W dimension will be(C-1,D) or (D,c-1) D: # of features and C:# of class**

- **Project the training data (X) using W, and call the projection Y.**

(+ 0.25 marks)

- **Use the projected data Y to classify the testing samples using LDA (use sklearn).**

(+0.5 marks)

- **Report accuracy and class-wise accuracy.**

(+0.25 marks + 0.5 marks) (only classwise accuracy allowed not classification report))
(the difference between our accuracy and student's accuracy should be +/- 10% otherwise reduce 0.25 marks for each case)

Our accuracy

```
Accuracy Score :  82.56
```

Our classwise accuracy

```
Accuracy for class name : T-shirt/top , is : accuracy :  76.8
Accuracy for class name : Trouser , is : accuracy :  94.0
Accuracy for class name : Pullover , is : accuracy :  71.5
Accuracy for class name : Dress , is : accuracy :  87.1
Accuracy for class name : Coat , is : accuracy :  78.8
Accuracy for class name : Sandal , is : accuracy :  89.0
Accuracy for class name : Shirt , is : accuracy :  60.5
Accuracy for class name : Sneaker , is : accuracy :  85.5
Accuracy for class name : Bag , is : accuracy :  91.60000000000001
Accuracy for class name : Ankle boot , is : accuracy :  90.8
```

Question 4 (2 Marks)

- **Apply PCA(using sklearn) on given data and set n components = the best value that you reported from Question-2.**

+(0.25 Marks)

- **Apply FDA(Reuse FDA implementation from question-3) on the trans- formed data which is received from step-1.**

+(0.5 Marks) (check W dimension, it should be (15,9) or (9,15) otherwise reduce 0.25 marks

- **Use the projected data received from step-2 and apply the classifier LDA to classify all testing samples.**

+(0.25 marks)

- **Report accuracy and class-wise accuracy from all testing samples.**

+(0.25 + 0.25 marks) (only classwise accuracy allowed not classification report))
(the difference between our accuracy and student's accuracy should be +/- 10% otherwise reduce 0.25 marks for each case)

Our accuracy score :

```
Accuracy Score :  80.39
```

Our classwise accuracy score:

```
Accuracy for class name : 0 , is : accuracy :  90.3061224489796
Accuracy for class name : 1 , is : accuracy :  91.45374449339208
Accuracy for class name : 2 , is : accuracy :  73.83720930232558
Accuracy for class name : 3 , is : accuracy :  79.40594059405942
Accuracy for class name : 4 , is : accuracy :  81.26272912423626
Accuracy for class name : 5 , is : accuracy :  64.79820627802691
Accuracy for class name : 6 , is : accuracy :  82.5678496868476
Accuracy for class name : 7 , is : accuracy :  83.85214007782102
Accuracy for class name : 8 , is : accuracy :  74.74332648870636
Accuracy for class name : 9 , is : accuracy :  78.79088206144698
```