SMAI Assignment 2

V. A. Lalitha Kameswari, 20171025

Question 1

A. **Eigen Faces:** The following table shows us the values of how many components we require for each of the three datasets provided, for representations 50% and 90% similar to the original one.

Dataset	50%	90%
IMFDB	3	49
CFW	7	247
Yale	5	13

Following are some key observations from the Eigenvalue Spectrum for each of the three datasets:

- **IMFDB Dataset:** The starting few large components are pretty close to each other. This means that during reconstruction, to achieve a good output, we would need lesser number of principal components, and this would also be advantageous computationally since these first few components are enough to capture the variance in the given image.
- **CFW Dataset:** Unlike the previous dataset, we need a large number of primary components for satisfactory reconstruction. This is because of the high disparity among the values. The first component captures a lot of variance, but the remaining vectors do not.

- **Yale Dataset:** There is high variance observed among the first few primary components, which again means that we need fewer components for reconstruction.

  All these three observations from the spectra are in correlation with our deductions about reconstruction.

B. Now we see the best accuracies for all the datasets:

The following table represents the results of training different models for different datasets

	Features used	Dimension Space	Classification error	Accuracy	F1score
0	pca(MLP)	100	0.1625	0.8375	0.8375
1	pca(SVM)	100	0.2125	0.7875	0.7875
2	pca(LR)	100	0.2125	0.7875	0.7875

	Features used	Dimension Space	Classification error	Accuracy	F1score
0	vgg(DTrees)	4096	0.355556	0.644444	0.644444
1	vgg(SVM)	4096	0.340741	0.659259	0.659259
2	vgg(LR)	4096	0.325926	0.674074	0.674074

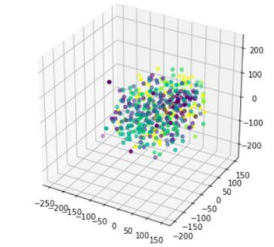
	Features used	Dimension Space	Classification error	Accuracy	F1score
0	resnet(SVM)	2048	0.030303	0.969697	0.969697
1	resnet(MLP)	2048	0.030303	0.969697	0.969697
2	resnet(DTrees)	2048	0.212121	0.787879	0.787879

As we observe in the above table, following are the best models obtained for each dataset

Dataset	Best Model	Accuracy
IMFDB	SVM	0.83
CFW	CFW	0.6
Yale	MLP	0.98

TSNE

The following plots show us the clustering of data after applying TSNE



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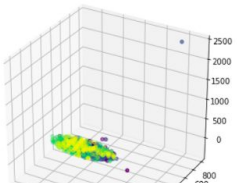
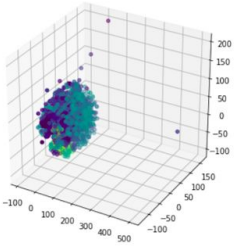
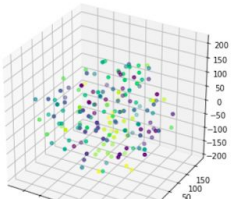






The three plots denote TSNE for 3 datasets and the 4 th plot represents TSNE for the entire dataset

KNN

For various values of K, we do the following:

Training: Plot the images in the 3072 dimensional space

Testing: Predict label based on the labels of K nearest neighbours

The below table represents accuracies for KNN model applied on all the datasets

	Features used	Dimension Space	Classification error	Accuracy	F1score
0	pca(K=7)	4096	0.3750	0.6250	0.969697
1	pca(K=5)	100	0.3375	0.6625	0.969697

	Features used	Dimension Space	Classification error	Accuracy	F1score
0	vgg(K=9)	2048	0.303704	0.696296	0.969697
1	vgg(K=5)	4096	0.318519	0.681481	0.969697

	Features used	Dimension Space	Classification error	Accuracy	F1score
0	resnet(K=7)	100	0.030303	0.969697	0.969697
1	resnet(K=9)	2048	0.030303	0.969697	0.969697

Extension - Politician vs FilmStar Classifier

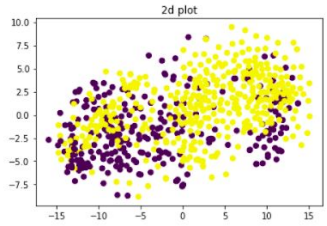
Politician	Filmstar
Obama	Aishwarya
Putin	Dwayne
Manmohan Singh	Amitab
Modi	Amir Khan

Why do we need the above classifier?

Social domain is an important part of any influencer's identity, as the social domain being different for the above two classes, differentiating them helps us to segregate people depending on their interests, people interested in films will focus on film-stars whereas people interested in politics would focus more on politicians, so above classifier helps us to differentiate people based on their interests

Implementation

I used Multi -Layer- Perceptron with 100 hidden neurons to train which gave an accuracy of 70% on the test set (Below picture shows TSNE plot of the data)



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