Assignment 6

EE698V – Machine Learning for Signal Processing

Submit your solutions at https://forms.gle/oHhWCpsF3nwdMKPT7

Q1. Prepare a **cheat sheet** of all the topics covered so far. Also, prepare a **mind map** for all the topics covered so far. **(20 marks)**

- This part can be done in groups (2 students/group); they both need to submit in their google form
- You can use Word, PowerPoint, latex or any software of your choice
- They could be up to 1-2 A4 pages only with font size>=10
- The top 3 cheat sheets and top 3 mind maps will be displayed

For the following questions, submit rendered jupyter notebooks (with commentation). You have to implement PCA, NMF and PLCA yourself, without using readymade implementations.

Q2. Consider MNIST digits. **(10 marks)**

a. Perform PCA, NMF and PLCA for **dimensionality reduction** to i) 2 and ii) 3 dimensions.
   i. Plot the transformed data as a 2D or 3D plot. Represent each digit with a different symbol.
   ii. Plot the basis vectors and reconstructed samples (one per digit).
b. Perform NMF for **classification**. Use K>=3 for each class. Train over the training set and test with the test set.
   i. Print the classification accuracy and the confusion matrix
   ii. Plot the basis vectors

Q3. Consider the audio data that you collected. Use four classes - speech, music, door knock and door closing. Extract magnitude spectrogram from each audio file, using window size 25ms and hop size 10ms. **(10 marks)**

a. Perform PLCA for **classification**. Use K>=3 for each class. Train over the training set and test with the test set.
   i. Print the classification accuracy and the confusion matrix
   ii. Plot the basis vectors

Note that each spectrum will form a vector. But for classifying an audio file, you can do pooling (majority vote or average score) over all the spectra in a spectrogram. To keep the data size manageable, you can use the folders assigned to you, plus a few other folders if you need.

Note: Make sure that you have deposited the correct audio data to Venkatesh during ass5. You will be using that entire dataset next time. Any discrepancies in folders will cause problems, and the owners (who were assigned those folders in ass5) will be responsible.