Assignment 05

Due Date - 24 February,2020

1. (a) Draw $\mathcal{N}$ points from the ellipse centered at $\mathcal{O}$ $(c_x, c_y) = (100, 100)$. The major axis makes an angle of $45°$ with the x-axis. Draw major axis $\overline{AOB}$ and minor axis $\overline{COD}$ of the ellipse,such that $|\overline{AO}| = |\overline{OB}| = 2a$ and $|\overline{CO}| = |\overline{OD}| = a$. Take $a = 20$.

   (b) Compute covariance matrix $\mathcal{C}$ of these points. Find eigen vectors $\widehat{e}_{max}$, $\widehat{e}_{min}$ and corresponding eigen values λ_{max}, λ_{min} . Draw lines $\widehat{e}_{max} = \overline{A_1OB_1}$ and $\widehat{e}_{min} = \overline{C_1OD_1}$ such that $|\overline{A_1O}| = |\overline{OB_1}| = k\sqrt{\lambda_{max}}$ and $|\overline{C_1O}| = |\overline{OD_1}| = k\sqrt{\lambda_{min}}$ respectively. Plot the lines for increasing values of $\mathbf{N}$.

2. (a) Download the Face Dataset(Yale face Dataset) from the following link: http://172.16.30.184:8090/Dataset/Yale.zip

   (b) Dataset has 11 instances of 15 faces.

   (c) Keep 10 instances of every face as the training set and the remaining ones as the testing set. The training set will have 150 face images and the testing set will have 15 face images .

   (d) Perform dimensionality reduction considering all training faces.

   (e) Visualize the eigen faces.

   (f) Take any test face and express it as a linear combination of the eigen faces.

   (g) For each test face, project the co-efficient vectors to a 2-D plane and visualize them.