

Consider the ICA problem. Given $A = \begin{bmatrix} 2 & 3 \\ 2 & 1 \end{bmatrix}$ and assuming that the two sources as statistically independent Gaussian random variables with mean zero and variance as unity, write the joined pdf of the mixed signal vectors (i.e. $P_{X_1, X_2}(x_1, x_2)$) (5 marks)

- (a) What are principal and independent components in PCA and ICA, respectively,
- (b) Write the difference between the two as far as the directions they find is concerned, (c) What is the difference between K-means clustering and GMM as far as the way in which they form the clusters is concerned. (6 marks)

In ICA, one cannot assume the independent sources (that are determined) as Gaussian distributed. Why? (2 marks)

Using the relationship derived in the class between output and input covariance matrices (i.e., C_Y and C_X) show that C_Y is diagonal in PCA transformation. Write only required steps (3 marks)

Question # 2



Compute and write the covariance matrix of input and the output in PCA for the following 2D data. Also write the principal component.

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = X = \begin{bmatrix} 2.5 & 0.5 & 2.2 & 1.9 & 3.1 \\ 2.4 & 0.7 & 2.9 & 2.2 & 3.0 \end{bmatrix} \quad (5 \text{ marks})$$

Question # 3

 Revisit

Formulate the problem and write the Lagrangian for soft margin SVM classifier. (4marks)