Submit a PDF file which includes Python codes, results, and discussions.
(Submit via the PandA system)

1. Consider two Gaussian distributions whose parameters are given as follows:

$$m_1 = \begin{bmatrix} 3 \\ 1 \end{bmatrix}, \Sigma_1 = \begin{bmatrix} 1 & 2 \\ 2 & 5 \end{bmatrix} \qquad m_2 = \begin{bmatrix} 1 \\ 3 \end{bmatrix}, \Sigma_2 = \begin{bmatrix} 1 & 2 \\ 2 & 5 \end{bmatrix}$$

(1) Show the scatter plot of bi-variate random numbers (2-d samples) generated from the above two distributions (use different colors or markers so that the two distributions can be distinguished).

(2) Apply PCA to the 2-d samples generated in (1) by assuming two distributions as a single sample set. Draw the 1st principal axis on the scatter plot in (1). **(Do not use built-in function of PCA)**

(3) Apply Fisher LDA to the 2-d samples generated in (1) by assuming the two distributions are two different classes. Draw the calculated axis on the scatter plot. **(Do not use built-in function of LDA)**

(4) Show the 1-d histograms of the sample data transformed by the calculated axes in (2) and (3).

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