# Introduction to Machine Learning

## Lab 3: Linear Classification

**Student ID: 111060013 Name: 劉祐廷**

## 1. Possible Reason for the Accuracy Change Between Perceptron and LDA

Perceptron and LDA share a similar basic idea, but Perceptron operates by finding a single point and the vector to the decision boundary through each epoch, whereas LDA uses the overall mean and variance to find the optimal solution. Perceptron's performance is significantly impacted when dealing with data that is not perfectly linearly separable. On the other hand, LDA, due to its nature of calculating based on the entire dataset, performs better when the data cannot be perfectly separated. Additionally, LDA aims to find a solution that minimizes the standard deviation within each class while maximizing the difference between the mean values of the two groups. This characteristic likely enhances LDA's generalization ability, leading to better prediction accuracy.

## 2. Does MAP help? Why?

Based on the results from this lab, it appears that MAP improves accuracy. The reason might be that the data points are not easily linearly separable. The advantage of using MAP is that it can handle data that cannot be easily separated by a linear boundary. MAP uses probabilities to determine which region a data point is more likely to belong to, rather than just finding a boundary in the space to separate the data. For non-linearly separable data, MAP tends to perform better in terms of accuracy compared to standard LDA.

## 3. How I Solve the Difficulty and My Reflections

This lab didn't present any major difficulties, but when performing matrix calculations, I spent some time thinking about whether I should multiply the transpose by the matrix itself or the matrix by its transpose.