

MA289 Intro to Statistical Learning

Bonus Assignment: Linear Discriminant Analysis (LDA)

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Due No Later Than 2359 on 19 FEB 2026 (Google Colab Submission)

This optional bonus assignment is intended to reinforce understanding of **Linear Discriminant Analysis (LDA)** using a simple, single-feature setting. You will generate synthetic data, implement the analytical LDA discriminant function, and visualize decision boundaries.

You may use **generative AI tools** to assist you; however, you are expected to first engage with the textbook, lesson notes, and the Lesson 13 Colab notebook. Any assistance used must be documented at the end of your notebook.

Assignment Tasks

1. Data Generation

Generate **1000 observations** from **three independent single-variate normally distributed classes** ($k = 3$). Each class should have a **different mean and variance of your choosing**. Provide a clearly labeled histogram visualizing the three classes.

2. LDA Implementation (Single Feature)

Implement the **analytical discriminant function for LDA** for a multiclass, single-feature problem. Use this discriminant to determine the class decision regions and compute the **vertical cut points** between classes.

3. Visualization and Interpretation

Create an updated histogram that includes the LDA decision boundaries. Clearly annotate and briefly explain how the discriminant function determines class membership.

4. Code Quality

Your code should be clearly commented, with each major step explained in plain language.

Submission Instructions

- Submit a **Google Colab notebook** to the shared Google Drive folder.
- The notebook must run without errors from top to bottom.
- Include a short section at the end documenting any external assistance used (including generative AI).

Grading Rubric (Bonus: 0–3 Points)

Criterion	Max Points	Score
1. Data Generation and Visualization – Correct generation of three normal classes – Clear and properly annotated histogram	1.0	_____
2. LDA Implementation and Decision Boundaries – Correct analytical discriminant function – Correct computation and display of cut points	1.0	_____
3. Code Clarity and Explanation – Clear comments and logical structure – Brief explanation of results and interpretation	1.0	_____
Total Bonus Points	3.0	_____

Proper completion of this assignment will result in up to **3 bonus points**. Partial credit may be awarded.