Mini Project: Machine Learning Design Patterns

Department of Artificial Intelligence

B.Tech – Semester IV
Kathmandu University

Objective

The goal of this mini project is to explore and implement one Machine Learning Design Pattern from the book: *Machine Learning Design Patterns* by Valliappa Lakshmanan et al. Students will learn how to identify a problem, apply a canonical design solution, critically review prior literature, and analyze trade-offs in real-world ML system development.

Instructions

- Each student is assigned a unique ML design pattern based on their roll number (see table below).

- Study the assigned pattern thoroughly from the book and supplementary research articles, conference papers, blogs, or official documentation.

- Conduct a short literature review (1–2 pages) discussing:
    - Origin of the pattern
    - Use in previous projects or case studies
    - Key papers or implementations (with citations)

- Implement the pattern on a suitable dataset (e.g., from Kaggle, UCI ML Repository, or BigQuery Public Datasets).

- Submit a Jupyter Notebook (or Google Colab) demonstrating:
    - Problem definition
    - Pattern implementation with code
    - Evaluation and visualizations
    - Benefits, trade-offs, and limitations

- Submit a report (3–6 pages) including the literature review, explanation, implementation, and results.

- Prepare a short 5-minute presentation/demo to share findings in class.

Deliverables

1. Jupyter Notebook / Colab Link

2. PDF Report (3–6 pages) with a separate section for Literature Review

3. Presentation Slides (optional)

Design Pattern Allocation (Based on Roll Number)

Roll No.	Assigned Pattern
1	Hashed Feature
2	Embeddings
3	Feature Cross
4	Multimodal Input
5	Reframing
6	Multilabel
7	Ensembles
8	Cascade
9	Neutral Class
10	Rebalancing
11	Useful Overfitting
12	Checkpoints
13	Transfer Learning
14	Distribution Strategy
15	Hyperparameter Tuning
16	Stateless Serving Function
17	Batch Serving
18	Continued Model Evaluation
19	Two-Phase Predictions
20	Keyed Predictions
21	Transform
22	Repeatable Splitting
23	Bridged Schema

Note: If there are more than 23 students, patterns may be reassigned or teams can be formed with approval.

Grading Criteria (Total: 20 Marks)

- Literature Review and Theoretical Understanding – 5 marks

- Result Evaluation and Interpretation – 4 marks

- Report Quality and Clarity – 3 marks

- Presentation and Demo – 3 marks

References: Book: *Machine Learning Design Patterns*, O'Reilly Media, 2020 GitHub: https://github.com/GoogleCloudPlatform/ml-design-patterns