Department of
Data Science and Artificial Intelligence
數據科學及人工智能學系

DSAI5207
Modern Deep Learning

Instructor & Logistics

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Logistics:

Wed, 18:30 – 21:30

TU101

https://learn.polyu.edu.hk/

Office Hours:
Wed 9:30-10:30 (Zoom/F2F)

1 Course Philosophy

The subject of Deep Learning has expanded rapidly, rendering traditional curriculums obsolete. This course adopts a **"Modern Perspective"**, specifically focusing on the **post-2015 era** of AI.
Unlike introductory courses that focus on conventional architectures, this course emphasizes the technologies driving today's AI revolution:

- **System-Level Integration:** Moving beyond models to build full DL systems.
- **Modern Data:** Handling real-world, messy, and multimodal data.
- **Frontier Models:** Large Language Models (LLMs), Diffusion, and GNNs.
- **Modern Stack:** PyTorch 2.0, Hugging Face, and Distributed Training.

2 Prerequisites

Math Foundations
Linear Algebra, Calculus, Probability (Bayes' Rule).

Programming
Python (Advanced), NumPy, PyTorch Basics.

ML Basics
Regression, Gradient Descent, Basic Neural Nets.

3 Assessment Scheme

The assessment focuses on **practice (50%)** to encourage hands-on innovation.

Component	Weight	Description
4 Assignments	20% (4×5%)	Jupyter Notebooks. Focused on implementation (e.g., Backprop from scratch, Fine-tuning).
Course Project	30%	Original Group Project. Aim for NeurIPS/CVPR quality ideas.
Midterm Exam	20%	2 Hours. Written theory and concept checks.
Final Exam	30%	Comprehensive assessment of modern DL concepts.

4 Tentative Schedule

Wk	Lecture Topic	Tutorial / Lab Focus	Key Dates
Part 1: Modern Training Techniques			
1	Intro & Linear Models	PyTorch Setup + Linear Regression	
2	MLPs & Backprop	Implementing MLP from scratch	**A1 Out**
3	Optimization & Init	Debugging training dynamics	
Part 2: Modern Architectures			
4	CNNs	Building CNN w/ PyTorch	**A1 Due** / A2 Out
5	RNNs, LSTMs, SSMs	RNN for Text Classification	
6	**Midterm Exam**	*Project Workshop (1 Hr)*	**A2 Due** / A3 Out
7	Transformers	HuggingFace Fine-tuning	**Team Up Due**
8	Graph Neural Networks	PyG & GNN Basics	**A3 Due** / A4 Out
			Proposal Due
9	DL Efficiency	Pruning & Quantization	
Part 3: Modern Generative Deep Learning			
10	LLMs	Prompting & LoRA	**A4 Due**
11	VAEs	VAE Implementation	
12	Diffusion Models	DDPM Sampling Demo	
13	Future Directions	Q&A + Project Highlights	**Final Proj. Due**

5 Policies & Integrity

Generative AI *"AI is your co-pilot, not your captain."*
You may use tools like ChatGPT for debugging, explaining concepts, or polishing text. You **must not** generate entire solutions or copy-paste code you do not understand.

Academic Integrity Zero tolerance for plagiarism. We utilize automated tools to detect code similarity. Violations will result in a score of 0 and disciplinary action.

Late Policy Late submissions incur a **10% penalty per day**. The maximum score drops as follows:
Day 1 (90%) → **Day 2 (80%)** → **Day 3 (70%)** → **>3 Days (0%)**.
Work is strictly not accepted after 72 hours without a medical certificate.

Recommended Resources

- **Course:** MIT EECS 6.S898 Deep Learning (https://phillipi.github.io/6.s898/)
- **Online Book:** Dive into Deep Learning (https://d2l.ai/)
- **Textbook:** *Deep Learning* (Goodfellow, Bengio, Courville) – The "Bible" of DL.