Information Theoretic Methods in Generative AI

Course Syllabus — Fall 2026

Course Information

Meeting Days/Time	Monday & Wednesday, 3:30 PM – 4:45 PM
Location	KUY 207
Semester Dates	August 24, 2026 – December 18, 2026
Instructor	Haoyue Tang — Department of Electrical Engineering
Email	haoyue@hawaii.edu
Office Hours	Friday 10:00–11:00 AM, POST 205E

Course Description

This course provides an introduction to deep generative models, the information-theoretic principles that underlie them, and their applications in image generation, as well as feature learning. Students will study the theory and practice behind the major families of generative models — autoregressive models, variational autoencoders, normalizing flows, flow matching, generative adversarial networks (GANs), energy-based models, score-based and diffusion models — and how they evolve towards today's generative models. The course combines lectures, written&coding with Q&A assignments, a reading report, and a final project.

Learning Objectives

- Explain foundational concepts in machine learning, probability, and information theory that underlie generative modeling.
- Compare and contrast the major families of deep generative models and their tradeoffs.
- Derive and implement training objectives for autoregressive models, VAEs, normalizing flows, flow matching, GANs, and diffusion models.
- Evaluate generative models using appropriate qualitative and quantitative metrics.
- Critically read and report on generative modeling research literature.
- Apply generative modeling techniques to a self-directed final project.

Prerequisites

Basic knowledge of probability and machine learning. Ability to code in PyTorch (use of AI coding assistants such as Claude or GPT is permitted).

Course Materials

No required textbook. Readings and lecture materials will draw on publicly available resources, including Stanford CS236 "Deep Generative Models" (Stefano Ermon) — `https://deepgenerativemodels.github.io/`. Additional readings will be posted per lecture.

Grading

Grading is based on three assignments — basic probability, a coding and Q&A assignment on GANs, and a coding and Q&A assignment on VAEs — each worth 15% of the final grade (45% total); a literature reading report worth 20%; and a final project worth 35%.

Course Policies

Late Work Late submissions will be graded at 50% of the original score.

Academic Integrity Students are expected to adhere to the UH Mānoa Student Conduct Code: `https://manoa.hawaii.edu/studentsuccess/conduct-code/`.

Accessibility (KOKUA) Students needing accommodations should contact the KOKUA Program (UH Mānoa Office for Students with Disabilities): `https://www.hawaii.edu/kokua/`.

Weekly Schedule

Topic sequence follows the general arrangement of Stanford CS236 "Deep Generative Models" (Stefano Ermon, Fall 2023), added recent advances in flow models. University holidays that fall on a class day are marked below.

Week	Monday	Wednesday	Coursework
Week 1	**Aug 24:** Introduction to Generative AI & Course Overview	**Aug 26:** Basics: Machine Learning, Probability & Information Theory	Assignment 1 (Probability) released
Week 2	**Aug 31:** Autoregressive Models	**Sep 2:** Maximum Likelihood Learning	
Week 3	***Sep 7: Holiday — Labor Day (No Class)***	**Sep 9:** Variational Autoencoders (VAEs) I	
Week 4	**Sep 14:** Variational Autoencoders (VAEs) II	**Sep 16:** Variational Autoencoders (VAEs) III	Assignment 1 due; Assignment 2 (VAE) released
Week 5	**Sep 21:** Normalizing Flows: Change of Variables & Architectures	**Sep 23:** Generative Adversarial Networks (GANs) I: Foundations	Assignment 2 due; Assignment 3 (GAN) released
Week 6	**Sep 28:** GANs II: Training Dynamics	**Sep 30:** GANs III: Architectures & Variants	
Week 7	**Oct 5:** GANs IV: Advanced Topics & Applications	**Oct 7:** Energy-Based Models I	Assignment 3 due
Week 8	**Oct 12:** Energy-Based Models II	**Oct 14:** Energy-Based Models III	
Week 9	**Oct 19:** Energy-Based Models IV	**Oct 21:** Score-Based Models	
Week 10	**Oct 26:** Evaluation of Generative Models	**Oct 28:** Score-Based Diffusion Models I	
Week 11	**Nov 2:** Final Project Proposal Discussion	**Nov 4:** Score-Based Diffusion Models II	Final project proposal due
Week 12	**Nov 9:** Discrete Latent Variable Models	***Nov 11: Holiday — Veterans Day (No Class)***	
Week 13	**Nov 16:** Flow Matching Models I	**Nov 18:** Flow Matching Models II	
Week 14	**Nov 23:** Diffusion Models for Discrete Data	**Nov 25:** Reading Report Discussion	Reading report due
Week 15	**Nov 30:** Final Project Work Session / Consultations	**Dec 2:** Final Project Presentations I	
Week 16	**Dec 7:** Final Project Presentations II	**Dec 9:** Course Review & Wrap-Up	Final project report due

Note: This schedule is a draft and may be adjusted as the semester progresses. Each row covers one week; edit the Monday/Wednesday cells directly to reassign content.