CS5494: TOPICS IN GENERATIVE AI

New Syllabus Proposal

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Topics in Generative AI

Subject Code
CS - Computer Science
Course Number
5494

Academic Unit
Computer Science (CS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course focuses on equipping students with a comprehensive understanding of various aspects within the realm of generative artificial intelligence (AI). Students will delve into topics including classical generative models such as VAE, GAN, AR, Flow, Diffusion, etc., and their applications to text, audio, image, video, 3D, and multimodal generation. By the end of the course, students are expected to possess the skills necessary to develop and evaluate generative AI models, and to apply them creatively in real-life applications. This is a topics course, and the course syllabus will be adjusted to fit the interests of the students.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Demonstrate a comprehensive understanding of various generative AI models and describe the connections and differences between them.			x	
2	Apply generative AI models for generation of text, audio, image, video, 3D model and multi-modal output and evaluate their performance.				x
3	Develop new generative AI models to address algorithmic shortcomings and solve real-life problems.				x
4	Document and report the evaluation and application of generative AI models through a written report and oral presentation.				x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	In the first 10 weeks of the course, students will engage in lectures about principles behind different generative AI algorithms and selected advanced topics related to their applications, such as the generation of text, audio, image, video, 3D model and multi-modal output.	1, 2	2 hours

2	Seminar	In the last 3 weeks, students will present their topics of interest in the form of a seminar.	2, 3, 4	2 hours
3	Tutorial	Each week, students will work on problems during the tutorial sessions to gain better understanding of the lecture material.	1, 2, 3	1 hour
4	Assignment	Students will derive/ design a generative AI model, implement, and test it.	1, 2, 3	2 assignments
5	Course Project	Students will design a system based on generative AI models to solve a real-life problem. Students will report their results in a course report.	2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Student-led seminar	2, 3, 4	10	Student (up to 3 students in each group) should attend and present their project in the seminar.	Yes
2	Assignment	1, 2, 3	30	At least 10% of the maximum mark must be obtained to pass this course.	Yes
3	Course Project	2, 3, 4	30	For a student to pass the course, at least 30% of the maximum mark for the examination AND course project must be obtained.	Yes

Continuous Assessment (%)

70

Examination (%)

30

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination AND course project must be obtained.

Assessment Rubrics (AR)

Assessment Task
1. Student-led Seminar

Criterion
1.1 ABILITY to EXPLAIN the principle of generative AI models and INTERPRET the results.

1.2 ABILITY to APPLY and DESIGN generative models for text, audio, image, video, 3D, or multimodal generation.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
2. Assignments

Criterion
2.1 ABILITY to APPLY and DESIGN generative AI models for text, audio, image, video, 3D, or multimodal generation.

2.2 ABILITY to EVALUATE, COMPARE, and CONTRAST different generative AI models.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task

3. Course Project and Presentation

Criterion
3.1 ABILITY to APPLY and DESIGN generative AI models to SOLVE real-world problems and INTERPRET the results.

3.2 ABILITY to EVALUATE, COMPARE, and CONTRAST different generative AI models.

3.3 ABILITY to REPORT about experiments on generative AI models.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
4. Examination

Criterion
4.1 ABILITY to EXPLAIN the principle of generative AI models and INTERPRET the results.

4.2 ABILITY to EVALUATE, COMPARE, and CONTRAST different generative AI models.

4.3 ABILITY to APPLY and DESIGN generative AI models for text, audio, image, video, 3D, or multimodal generation.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

Topics will be adjusted according to student interests. Possible topics will include:

- Classical generative AI models
  - Variational autoencoder (VAE).
  - Generative adversarial network (GAN).
  - Flow-based generative model
  - Autoregressive transformer
  - Diffusion model
- Application of generative AI models
  - Large language model (LLM)
  - Text-to-speech synthesis and musical composition
  - Image generation
  - Video generation
  - 3D representation (mesh, point cloud, NeRF, Gaussian Splatting) and 3D generation
  - Multimodal large language model (MLLM)
  - Mixture of experts(MoE)
- Others
  - Prompting engineering
  - In-context learning
  - Model distillation
  - Model customization

Reading List

Additional Readings

	Title
1	David Foster, “Generative Deep Learning: Teaching Machines To Paint, Write, Compose, and Play (2nd Ed.)”, O'Reilly, 2023.
2	Omar Sanseviero, Pedro Cuenca, Apolinário Passos, Jonathan Whitaker, “Hands-On Generative AI with Transformers and Diffusion Models”, O'Reilly, 2024.
3	“Basic Generative AI: Beginner's Guide to Artificial Intelligence, ChatGPT and Machine Learning, Practical AI Applications”, Freeman Publishing, 2024.