THE CHINESE UNIVERSITY OF HONG KONG
Print Course Catalog Details

Academic Org: Div of Computer Science & Engg – Subject: AI: Systems & Tech

Course: AIST5030 **Course ID:** 014509 **Eff Date:** 2024-07-01 **Crse Status: Active** **Apprv. Status:** Approved **[**New Course**]**
Generative Artificial Intelligence 生成式人工智能

The course aims at equipping students with an overview of latest generative AI (GenAI) technologies that generate various types of data, e.g., images, videos, audios, text, code, music and molecules, etc. that are profoundly impacting the industry and society. The course will provide a comprehensive understanding of the fundamental concepts and techniques behind GenAI, including generative models, probabilistic models, deep learning architectures, and self-supervised/unsupervised learning, etc. The advanced topics of large language models, conversational AI and mutli-modality generative AI will be further explored. Applications on speech and conversational data will be introduced to illustrate the concepts and techniques of GenAI. The ethical and social implications of GenAI will also be discussed in the course, so that students can critically analyze the impact of GenAI on society and propose ethical guidelines for its development and deployment. Ample opportunities will be provided to students to apply what they have learned in class through hands-on implementation and research paper on course projects. The course is suitable for students who have some background in machine learning, probability, statistics, and linear algebra .

本課程旨在為學生提供最新生成式人工智能（GenAI）技術的概述，該技術能夠生成各種類型的數據，例如圖像、視頻、音頻、文本、代碼、音樂和分子等，對行業和社會產生深遠影響。本課程將全面了解GenAI背後的基本概念和技術，包括生成模型、概率模型、深度學習架構以及自監督/無監督學習等。此外，還將進一步探討大型語言模型、對話式人工智能和多模態生成式人工智能等高級主題。課程將介紹語音和對話數據的應用，以說明GenAI的概念和技術。課程還將討論GenAI的道德和社會影響，以便學生能夠批判性地分析GenAI對社會的影響並提出其發展和部署的道德指南。課程將提供豐富的機會讓學生通過實踐和研究論文在課程項目中應用所學知識。本課程適合具有一定機器學習、概率、統計和線性代數背景的學生。

Grade Descriptor:

A

EXCELLENT – exceptionally good performance and far exceeding expectation in all or most of the course learning outcomes; demonstration of superior understanding of the subject matter, the ability to analyze problems and apply extensive knowledge, and skillful use of concepts and materials to derive proper solutions.

有關等級說明的資料，請參閱英文版本。

B

GOOD – good performance in all course learning outcomes and exceeding expectation in some of them; demonstration of good understanding of the subject matter and the ability to use proper concepts and materials to solve most of the problems encountered.

有關等級說明的資料，請參閱英文版本。

C

FAIR – adequate performance and meeting expectation in all course learning outcomes; demonstration of adequate understanding of the subject matter and the ability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

D

MARGINAL – performance barely meets the expectation in the essential course learning outcomes; demonstration of partial understanding of the subject matter and the ability to solve simple problems.

有關等級說明的資料，請參閱英文版本。

F

FAILURE – performance does not meet the expectation in the essential course learning outcomes; demonstration of serious deficiencies and the need to retake the course.

有關等級說明的資料，請參閱英文版本。

Equivalent Offering:
Units: 3 (Min) / 3 (Max) / 3 (Acad Progress)
Grading Basis: Graded
Repeat for Credit: N
Multiple Enroll: N
Course Attributes: MSc Computer Science
MPhil-PhD Computer Sci & Erg

Topics:

COURSE OUTCOMES

Learning Outcomes:

Upon completion of this course, students would be able to:

- Acquire a solid understanding of the principles and concepts underlying GenAI technologies that are profoundly impacting the industry and society;
- Develop a strong foundation in GenAI, with practical skills for implementing and applying generative models to various domains;
- Develop an awareness of the ethical and social implications associated with GenAI. Students will be able to critically analyze issues such as bias, fairness, privacy, and the responsible deployment of generative models;
- Gain practical experience in planning and delivering a group project based on latest technologies.

Course Syllabus:

1 - Introduction to generative AI
2 - Deep learning for generative AI (Transformer, self-supervised learning, contrastive learning)
3 - Fundamentals of generative models (I) (Autoregressive models, seq2seq models)
4 - Fundamentals of generative models (II) (VAEs, GANs)
5 - Fundamentals of generative models (III) (Flow-based models, diffusion models)
6 - Language models and prompt engineering
7 - ChatGPT and conversational AI
8 - Generative AI in expressive speech generation
9 - Generative AI in audio generation and music composition
10 - Generative AI in image and video generation
11 - Ethical and socail implications of generative AI
12 - Group presentation (I)
13 - Group presentation (II)

Assessment Type:

Homework or assignment	: 30%
Presentation	: 20%
Project	: 15%
Report	: 35%

Feedback for Evaluation:

1. Result of homework and assignments.
2. Course evaluation and questionnaire.
3. Reflection of teachers.
4. Question-and-answer sessions during class.
5. Student consulation during office hours or online.

Required Readings:

1. Aditya Grover and Stefano Ermon, (2018), Tutorial on Deep Generative Models, IJCAI-ECAI
2. Jun-Yan Zhu, Taesung Park, Mihaela Rosca, Phillip Isola, and Ian Goodfellow, (2018), Tutorial on GANs. CVPR
3. Shakir Mohamed and Danilo Rezende, (2017), Tutorial on Deep Generative Models. UAI

Recommended Readings:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville (2016), Deep Learning, MIT Press
2. Jurafsky Daniel, Martin James, Norvig Peter, Russell Stuart (2014), Speech and Language Processing, Pearson
3. Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin (2017), Attention Is All You Need, Advances in Neural Information Processing Systems
4. Jacob Einstein (2019), Introduction to Natural Language Processing, MIT Press
5. Long Ouyang, et al., (2022), Training language models to follow instructions with human feedback, Advances in Neural Information Processing Systems
6. Yang Song et. al., (2021), Score-Based Generative Modeling through Stochastic Differential Equations, International Conference on Learning Representation

OFFERINGS

1. AIST5030	Acad Organization=CSEGV; Acad Career=RPG

COMPONENTS

LEC : Size=60; Final Exam=Y; Contact=3

ENROLMENT REQUIREMENTS

1. AIST5030

Enrollment Requirement Group:

For students in MSc Computer Science; or
For students in MPhil-PhD Computer Science and Engineering;
Not for students who have taken SEEM5030

New Enrollment Requirement(s):

Exclusion = SEEM 5030
Other Requirement = For students in MSc Computer Science; or
For students in MPhil-PhD Computer Science and Engineering

Additional Information

eLearning hrs for blended cls	0
VTL-Onsite face-to-face hrs	0
VTL-Online synch. hrs	0
VTL-Online asynch. hrs	0
No. of micro-modules	0

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