Generative Artificial Intelligence

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 multi-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.

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.

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.

C

有關等級說明的資料，請參閱英文版本。
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: 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 social implications of generative AI
12 - Group presentation (I)
13 - Group presentation (II)

Assessment Type:

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<thead>
<tr>
<th>Assessment Type</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework or assignment</td>
<td>30%</td>
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<tr>
<td>Presentation</td>
<td>20%</td>
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<tr>
<td>Project</td>
<td>15%</td>
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<tr>
<td>Report</td>
<td>35%</td>
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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 consultation during office hours or online.

Required Readings:

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
4. Jacob Einstein (2019), Introduction to Natural Language Processing, MIT Press

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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