



THE CHINESE UNIVERSITY OF HONG KONG
DEPARTMENT OF CSE ENGINEERING

COURSE OUTLINE

CMSC5707 Advanced Topics in Artificial Intelligence

<https://blackboard.cuhk.edu.hk/ultra/courses/CMSC5707>

1. Course description

This course will cover selected topics from: advanced pattern recognition, neural networks, expert systems and fuzzy systems, evolutionary computing, learning theory, constraint processing, logic programming, probabilistic reasoning, computer vision, speech processing, and natural language processing.

2. Number of credit units: 3

3. Course timetable

2025-26	Semester 1	<u>Venue</u>
Lecture	Wednesday: 18:30 to 21:15	YIA LT4

4. Course instructor

Name: Professor Wong Kin Hong
Office Location: SHB1012
Telephone: 3943-8415
Email Address: khwong@cuhk.edu.hk

5. Teaching assistants: (Name, Building/Room Number, Email Address, Office hours)

	<u>Name</u>	<u>Office</u>	<u>Telephone</u>	<u>Email:</u>
1.	None			
2.				
3.				

6. Learning outcomes

At the end of the course of studies, students will have acquired the ability to

1. understand audio signal processing procedures and methods of extracting important audio features from audio signals
2. build a simple small vocabulary speech recognition system
3. understand pattern classification methods such as boosting and neural networks
4. know how to perform simple classification problems using boosting and neural networks
5. understand the nature of fuzzy concept in real life
6. familiarize with the fuzzy concepts and fuzzy logic and their application in fuzzy expert system
7. design and implement fuzzy expert system in solving real life problem

7. Use of course website

The course website <https://blackboard.cuhk.edu.hk/ultra/courses/CMSC5707> is available on Blackboard for the distribution of course-related announcements, documents, lecture notes, and tutorial materials.

8. Teaching mode and learning activities (select/revise the items and descriptions)

Inside classroom (face-to-face)

- Lectures
 - The lectures cover the principles of the course topics according to the teaching plan.
- Assignments
 - 3 online assignments

Online

- Reading materials
(<https://www.cse.cuhk.edu.hk/%7Ekhwong/www2/cmsc5707/cmsc5707.shtml>)
- Assignments exercise in Blackboard

9. Teaching schedule and content

<u>Week</u>	<u>Date</u>	<u>Topics/Content</u>	<u>Remarks</u>
1	September 3, 2025	Overview. Ch1a: Introduction to audio signal processing : Time/frequency signals, Spectrogram, Mel Scale Cepstral coeff., MFCC	
2	September 10, 2025	Ch1b. Vector quantization and K-means, K-NN, Dynamic programming for speech recognition	

3	September 17, 2025	Ch2. ensemble methods.: Classifiers, boosting	
4	October 8, 2025	Ch3. Face detection :Face features, Attentional,cascade,	
5	October 15, 2025	Ch4. Neural Networks : Basic neural network and training	
6	October 22, 2025	Ch6. Ch5. Convolution Neural Network CNN : Convolution Neural Network CNN, Softmax	
7	October 29, 2025	Ch 6 : AutoEncoder: Classical and Variational AutoEncoder	
8	November 5, 2025	Ch 7 : RNN_LSTM : Recurrent Neural Net, Long short-Term Memory	
9	November 12, 2025	Ch 8 : Word representation and seq2seq : Word embedding, Machine translation,	
10	November 19, 2025	Ch 9 : Transformer_Ilm: The transformer model, Large Lang. Model LMM	
11	November 26, 2025	Ch10 : Decision tree : Decision tree using Gini and information gain by entropy	
12	December 3 , 2025	Ch11 : Reinforcement learning : Q learning	
13	December 10 , 2025	Final Exam	

10. **Assessment type, percentage, policies and rubrics (select/revise the types and weightings)**

<u>Assessment type</u>	<u>Weighting (%)</u>	<u>Remarks</u>
▪ Class Participation	0	
▪ Assignments	40	
▪ Quiz	0	
▪ Midterm Test	0	
▪ Final Examination	60	
▪ Project / Report		
100		

Policy for Late submission: (Select / revise)

- NO late submission will be accepted.

Policy for Absence from test examinations: (Select / revise)

- For quiz/test/examinations arranged by course instructor:
 - **Absence due to non-medical reasons:** submit absence request to course instructor at least 1 week in advance of the exam date, with supporting documents from the organizer involved.
 - **Absence due to medical reasons on exam/test day:** submit valid medical proof issued by registered medical doctor in Hong Kong to course instructor within 2 calendar days after the exam/test date.
 - No make-up exam or special arrangements will be arranged if the above requirements are not met.
 - Final decision will be made by the course instructor.
- For centralized examinations arranged by (Registration and Examination Section) RES:
 - Make-up examinations can be requested according to the rules set by RES.

To be announced.

Grade Descriptors:

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.

A-

B+,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.

B-

C+,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.

C-

D+, 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.

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.

Recommended readings

Recommended readings

- Books
 - R. S. Sutton and A. G. Barto, Reinforcement Learning: An Introduction, 2nd ed. The MIT Press, 2018
 - Learning, Deep. "Ian goodfellow, yoshua bengio, aaron courville." (2016).<https://www.deeplearningbook.org/>
 - Lawrence Rabiner, Ronald Schafer, Theory and Applications of Digital Speech Processing, Pearson 2011
 - Becchetti and Ricotti, Speech recognition: Theory and C++ Implementation, Wiley, 1999
 - Lawrence Rabiner and Biing-Hwang Juang, Fundamentals of Speech Recognition, Prentice Hall 1993
 - bookboon (Free text books)
 - Speech and Language Processing : <https://web.stanford.edu/~jurafsky/slp3/ed3book.pdf>
- Web sites
 - PHYSICAL AUDIO SIGNAL PROCESSING by J.O.Smith
 - Unix environment
 - Speech signal processing toolbox
 - Matlab toolboxes
 - Audio Signal Processing Basics
 - mirtoolbox contains many useful audio processing library functions.
 - VOICEBOX: Speech Processing Toolbox for MATLAB
 - Audio processing in Matlab
 - Music
 - Simple Music in MATLAB

11. Feedback for evaluation

Students are encouraged to give comments and make suggestions using the following channels:

1. There is a course evaluation at the end of the course. This is a formal channel for students to rate the teacher, the course, and the course tutors. Students can give specific comments or suggestions in addition to the numeric ratings.
2. Students can provide feedbacks using informal channels, such as email, or simply by discussing with the tutors or the instructor directly.

12. Academic honesty and plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details may be found at

<http://www.cuhk.edu.hk/policy/academichonesty> (CUHK)

<https://www.erg.cuhk.edu.hk/erg/AcademicHonesty> (Engineering Faculty)

With each assignment, students will be required to submit a signed **declaration** (Attachment) that they are aware of these policies, regulations, guidelines and procedures.

- In the case of group projects, all members of the group should be asked to sign the declaration, each of whom is responsible and liable to disciplinary actions, irrespective of whether he/she has signed the declaration and whether he/she has contributed, directly or indirectly, to the problematic contents.

- For assignments in the form of a computer-generated document that is principally text-based and submitted via VeriGuide, the statement, in the form of a receipt, will be issued by the system upon students' uploading of the soft copy of the assignment.
- Students are fully aware that their work may be investigated by AI content detection software to determine originality.
- Students are fully aware of the AI approach(es) adopted in the course. In the case where some AI tools are allowed, students have made proper acknowledgment and citations as suggested by the course teacher.

Assignments without a properly signed declaration will not be graded by teachers.

Only the final version of the assignment should be submitted via VeriGuide.

The submission of a piece of work, or a part of a piece of work, for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration to this effect shall be regarded as having committed undeclared multiple submissions. It is common and acceptable to reuse a turn of phrase or a sentence or two from one's own work; but wholesale reuse is problematic. In any case, agreement from the course teacher(s) concerned should be obtained prior to the submission of the piece of work.

The copyright of the teaching materials, including lecture notes, assignments and examination questions, etc., produced by staff members/ teachers of The Chinese University of Hong Kong (CUHK) belongs to CUHK. Students may download the teaching materials produced by the staff members/ teachers from the Learning Management Systems, e.g. Blackboard, adopted by CUHK for their own educational use, but shall not distribute/ share/ copy the materials to a third-party without seeking prior permission from the staff members/ teachers concerned.

14. Use of Generative Artificial Intelligence (AI) Tools in Teaching, Learning and Assessment

Approach 1 - All use of AI tools is prohibited in assignments and assessment tasks

15. Guideline on sharing lecture recordings

Attention is drawn to the following:

- The copyright of any lecture recordings shared in the course, whether they are produced by teachers, students, or peer note-takers, belongs to the University.
- Students should not share these recordings with others without obtaining prior written consent from the teacher(s).

Attachment

Declaration for written assignment

I am/we are submitting the assignment for:

- ☐ an individual project or
- ☐ a group project on behalf of all members of the group. It is hereby confirmed that the submission is authorized by all members of the group, and all members of the group are required to sign this declaration.

I/We declare that: (i) the assignment here submitted is original except for source material explicitly acknowledged/all members of the group have read and checked that all parts of the piece of work, irrespective of whether they are contributed by individual members or all members as a group, here submitted are original except for source material explicitly acknowledged; (ii) the piece of work, or a part of the piece of work has not been submitted for more than one purpose (e.g. to satisfy the requirements in two different courses) without declaration; and (iii) the submitted soft copy with details listed in the <Submission Details> is identical to the hard copy(ies), if any, which has(have) been / is(are) going to be submitted. I/We also acknowledge that I am/we are aware of the University's policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained in the University website <http://www.cuhk.edu.hk/policy/academichonesty/>.

In the case of a group project, we are aware that all members of the group should be held responsible and liable to disciplinary actions, irrespective of whether he/she has signed the declaration and whether he/she has contributed, directly or indirectly, to the problematic content.

I/we declare that I/we have not distributed/ shared/ copied any teaching materials without the consent of the course teacher(s) to gain unfair academic advantage in the assignment/ course.

I/we declare that I/we have read and understood the University's policy on the use of AI for academic work. I/we confirm that I/we have complied with the instructions given by my/our course teacher(s) regarding the use of AI tools for this assignment and consent to the use of AI content detection software to review my/our submission.

I/We also understand that assignments without a properly signed declaration by the student concerned and in the case of a group project, by all members of the group concerned, will not be graded by the teacher(s).

Signature(s)

Date

Name(s)

Student ID(s)

Course code	Course title
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Appendix (DELETE the Appendix after copying the chosen approach description to section 14)

Approach 1 – Prohibit all use of AI tools

In assessing the level of achievement of learning outcomes and students' performance, students are expected to produce their own work independently without any collaboration with the use of AI tools.

All use of AI tools is prohibited in assignments and assessment tasks

For assignments and assessment tasks that count towards the final course grades, students are not allowed to submit work which is produced with the collaboration of or supported by the use of any generative AI tools (e.g. ChatGPT)*.

Any breach of the regulations will be considered an act of academic dishonesty and will be handled according to the University's *Procedures for Handling Cases of Academic Dishonesty*.

In case of queries, students should seek advice from the course teacher.

* Teachers may add examples of AI tools relevant to their disciplines.

Approach 2 – Use only with prior permission

If teachers find it appropriate for students to use some AI tools in some in-class activities and assignments, students should be clearly informed of (1) which AI tools are allowed; (2) when, how and why these tools can / cannot be used; and (3) how the tools should be cited and acknowledged. Students should also be informed of the limits and appropriate use of these tools.

Use of some AI tools is allowed

Students may use some AI tools in some in-class activities and assignments on the following conditions:

1. The AI tools to be used are restricted to the following tools: (*Specify the AI tools that are allowed. Teachers may also specify which AI tools are not allowed*) ;
2. The specified AI tools will only be allowed for the following types of class activities and assignments: (*Specify the activities and / or assignments*)
3. Collaboration of AI tools is only allowed for the following purposes / tasks: (*Specify the purposes / tasks for which the AI tools can be used or used with certain restrictions, if any*);
4. The input contributed by the AI tools are properly acknowledged and cited ; and
5. The input together with the prompts used to elicit the AI responses should be highlighted or included as appendices wherever appropriate.

Acknowledging support from AI tools

Students are required to acknowledge all functional uses of a generative AI tool and cite it when they paraphrase, quote, or incorporate into their own work any content (whether it is text, image, data, or other format) that was created by it.

- i. An example of acknowledgement

'I acknowledge the use of (name of AI tool – e.g. ChatGPT (<https://chat.openai.com/>) to (specify the support, e.g. plan my essay, generate some ideas for the content, ask for examples of data collection instruments, get the dates of historical events, etc.).

ii. An example of citation
OpenAI. (2023). *ChatGPT* (Mar 20 version). <https://chat.openai.com/chat>

(Students are reminded that due to the rapid developments of generative AI tools, some citation formats may be updated regularly.)

iii. An example of including texts generated by an AI tool in their work

"The following text was generated by an AI tool / language model (ChatGPT):"
[Insert the text generated by ChatGPT here.]

iv. An example of including texts generated by an AI tool and the prompts that were used to elicit the text from the AI tool

"[The prompt], as generated by an AI language model (ChatGPT):"
[Insert the text generated by ChatGPT in response to the prompt.]

Students are reminded to learn and use the AI tools responsibly and ethically and be aware of the limitations.

Students are reminded to clarify with the course teacher and obtain permission if necessary when in doubt.

Approach 3 - Use only with explicit acknowledgement

In courses where students are allowed or expected to collaborate with or use AI tools for in-class learning activities or assignments, students should be reminded to make explicit acknowledgement of the use of these tools. Teachers may show students examples regarding how to acknowledge and make citations. Students should also be informed of the limitations and appropriate use of these tools.

Use of AI tools is allowed with explicit acknowledgement and proper citation

Students may use some AI tools in some class activities and assignments on the condition that they make explicit acknowledgement and proper citations of the input from AI tools.

Acknowledging support from AI tools

Students are required to acknowledge all functional uses of a generative AI tool and cite it when they paraphrase, quote, or incorporate into their own work any content (whether it is text, image, data, or other format) that was created by it.

i. An example of acknowledgement

'I acknowledge the use of (name of AI tool – e.g. ChatGPT (<https://chat.openai.com/>) to (specify the support, e.g. plan my essay, generate some ideas for the content, ask for examples of data collection instruments, get the dates of historical events, etc.).

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"The following text was generated by an AI tool / language model (ChatGPT):"

[Insert the text generated by ChatGPT here.]

- iv. An example of including texts generated by an AI tool and the prompts that were used to elicit the text from the AI tool

"[The prompt], as generated by an AI language model (ChatGPT):"

[Insert the text generated by ChatGPT in response to the prompt.]

Students are reminded to learn and use the AI tools responsibly and ethically and be aware of the limitations.

Students are reminded to clarify with the course teacher and obtain permission if necessary when in doubt.

Approach 4 – Use of AI tools is freely permitted with no acknowledgement

In courses where students are allowed or expected to frequently collaborate with or use AI tools when engaging in learning activities and completing assignments, teachers may decide that students are not required to acknowledge and cite explicitly the use of these tools. Details on which AI tools are to be used should be stated clearly in the course outline. Students should also be reminded of the limitations and appropriate uses of these tools.

Use of some AI tools is allowed with no acknowledgement

Students may use the following AI tools in some in-class activities and assignments: (*Specify the AI tools that are allowed*).

Students are reminded to learn and use AI tools responsibly and ethically and be aware of the limitations.