UNIVERSITY of HOUSTON

COLLEGE OF NATURAL SCIENCES & MATHEMATICS HTTP://NSM.UH.EDU

COURSE TITLE/SECTION: Foundations of Artificial Intelligence (COSC 4368)
TIME: MO/WE 1-2:30p
CLASS ROOM: none (MS Team 4368-Class will be used)
FACULTY: Christoph F. Eick **OFFICE HOURS**: MO 2:30-3:30p WE 9:30-10:30a
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Revised on April 5, 2021

Course *Fundamentals of Artificial Intelligence (COSC 4368)*

A. Catalog Description

Prerequisite: COSC 2320 or COSC 2430.

Description: An overview of main topics in the field of artificial intelligence. Topics include search techniques, reasoning with logic, planning, decision making, machine learning, and robotics.

B. Purpose

This course introduces students to the basic knowledge representation, problem solving, reasoning, and learning methods of artificial intelligence. Upon completion COSC 4368 students should be able to develop intelligent systems by assembling solutions to concrete computational problems; understand the role of knowledge representation, problem solving,, and learning in intelligent-system engineering and appreciate the role of problem solving, learning and reasoning in understanding human intelligence from a computational perspective. In particular students will get exposure to the following themes:

- More general themes:
  - Search algorithms
  - Probabilistic reasoning
  - Making sense out of data/data science
- AI-specific Topics:
  - Heuristic search, constraint satisfaction problems, and Games
  - Learning from examples and reinforcement learning
  - Deep learning
  - Evolutionary computing
  - game theory
  - Reasoning in uncertain environments and belief networks
  - Ethics and societal aspects of AI
  - Logical reasoning and planning
- Exposure to AI tools (belief networks, neural networks, maybe support vector machines, generative artificial networks)

C. Course Objectives

Upon completion of this course, students

1. will know what the goals and objectives of artificial intelligence are
2. will have a basic understanding and obtain practical experience on how to build real-world intelligent systems
3. will have sound knowledge of popular classification and prediction techniques, such as artificial neural networks and support vector machines.
4. will learn how to build systems that explore and act in unknown and changing environments intelligently
5. will sound knowledge of popular search algorithms and heuristic search
6. will have a basic understanding of approaches to reason in uncertain environments including Naïve Bayes, Belief Networks, and Hidden Markov Models.
7. will get some exposure to the ethical and societal problems associated with developing, deploying and using AI systems
8. will get some exposure to evolutionary computing, game theory, convolutional neural networks (CNN) and generative artificial networks (GAN)
9. will get exposure to peer reviewing some problem set task solutions of other students and the group project. The peer reviewing tool Kritik will be used for peer reviewing tasks.

D. Course Content

I. Introduction to Artificial Intelligence
II. Problem Solving, Search and Games
III. Brief Introduction to Evolutionary Computing
IV. Brief Introduction to Game Theory
V. Machine Learning centering on Supervised Learning and Reinforcement Learning
VI. Deep Learning
VII. Decision Making and Reasoning in Uncertain Environments
VIII. Ethical and Societal Aspects of AI
IX. Logical Reasoning and Planning (optional topic; likely not covered due to the 2 winter storm lecture cancellations in Feb. 2021)

E. Course Elements

23 lectures
Microsoft Teams will be used the platform to deliver these online lectures
2 exams
1 group project (centering on reinforcement learning
1 group online credit task (groups present solutions to homework-style problem during the lecture)
3 problem sets (containing "challenging" paper and pencil problems, small or medium sized implementation tasks, and tasks which use AI tools; Problem Set1 centers on Search,

Problem Set2 centers on Supervised Learning and GANs and Problem Set3 centers on Using and Designing Belief Network and on Societal and Ethical Aspects of AI)
2 review sessions (35 minutes each)

F. Textbooks

Recommended Text:

S. Russell and P. Norvig, *Artificial Intelligence, A Modern Approach*, Forth Edition, Prentice Hall/Allyn&Bacon, November 2021

G. Evaluation and Grading

Midterm Exam: 19%
Final Exam: 28%
Group Project: 18%
Problem Sets[1]: 30%
Attendance and online credit: 5%

Remark: Weights are tentative and subject to change!

Translation number to letter grades:
A:100-90 A-:90-86 B+:86-82 B:82-78 B-:78-74 C+:74-70
C: 70-66 C-:66-62 D+:62-58 D:58-54 D-:54-50 F: 50-0

Students may discuss course material and homeworks, but must take special care to discern the difference between **collaborating** in order to increase understanding of course materials and collaborating on the homework / course project itself. We encourage students to help each other understand course material to clarify the meaning of homework problems or to discuss problem-solving strategies, but it is **not** permissible for one student to help or be helped by another student in working through homework problems and in the course project. If, in discussing course materials and problems, students believe that their like-mindedness from such discussions could be construed as collaboration on their assignments, students must cite each other, briefly explaining the extent of their collaboration. Any assistance that is not given proper citation may be considered a violation of the Honor Code, and might result in obtaining a grade of F in the course, and in further prosecution.

Policy on grades of I (Incomplete): A grade of 'I' will only be given in extreme emergency situations and only if the student completed more than 2/3 of the course work.

1 This includes credit for peer reviewing

Addendum: Whenever possible, and in accordance with 504/ADA guidelines, the University of Houston will attempt to provide reasonable academic accommodations to students who request and require them. Please call 713-743-5400 for more assistance.

H Course Policies

Excused Absence Policy

Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Class

Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Center for Students with DisABILITIES. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and notetaking. Instructor's recordings are not authorized to be shared with *anyone* without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Syllabus Changes

Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible through (*specify how students will be notified of changes*).

Resources for Online Learning

The University of Houston is committed to student success, and provides information to optimize the online learning experience through our Power-On website. Please visit this website for a comprehensive set of resources, tools, and tips including: obtaining access to the internet, AccessUH, and Blackboard; requesting a laptop through the Laptop Loaner Program; using your smartphone as a webcam; and downloading Microsoft Office 365 at no cost. For questions or assistance contact UHOnline@uh.edu.

UH Email

Email communications related to this course will be sent to your Exchange email account which each University of Houston student receives. The Exchange mail server can be accessed via Outlook, which provides a single location for organizing and managing day-to-day information, from email and calendars to contacts and task lists. Exchange email accounts can be accessed by logging into Office 365 with your Cougarnet credentials or through Access UH. Additional assistance can be found at the Get Help page.

Webcams

Access to a webcam is required for students participating remotely in this course. Webcams must be turned on (*state when webcams are required to be on and the academic basis for requiring them to be on*). (*Example: Webcams must be turned on during exams to ensure the academic integrity of exam administration*.)

Honor Code Statement

Students may be asked to sign an honor code statement as part of their submission of any graded work including but not limited to projects, quizzes, and exams: "*I understand and agree to abide by the provisions in the (select: University of Houston Undergraduate Academic Honesty Policy, University of Houston Graduate Academic Honesty Policy*). *I understand that academic honesty is taken very seriously and, in the cases of violations, penalties may include suspension or expulsion from the University of Houston."*

Course Delivery Formats and Final Exams

This course is being offered in the Synchronous Online format. Synchronous online class meetings will take place according to the class schedule. There is no face-to-face component to this course. In between synchronous class meetings, there may also be asynchronous activities to complete (e.g., discussion forums and assignments). This

course will have a final exam per the University schedule. The exam will be delivered in the synchronous online format, and the specified date and time will be announced during the course. Prior to the exam, descriptive information, such as the number and types of exam questions, resources and collaborations that are allowed and disallowed in the process of completing the exam, and procedures to follow if connectivity or other resource obstacles are encountered during the exam period, may be provided.

Interim Grading Policy

We do not have an interim grading policy this term ('S' or 'NCR') for either undergraduate or graduate students.

Other Helpful Information

COVID-19 Updates: https://uh.edu/covid-19/

Coogs Care: https://www.uh.edu/dsaes/coogscare/

Laptop Checkout Requests: https://www.uh.edu/infotech/about/planning/off-campus/index.php#do-you-need-a-laptop

Health FAQs: https://uh.edu/covid-19/faq/health-wellness-prevention-faqs/

Student Health Center: https://uh.edu/class/english/lcc/current-students/student-health-center/index.php