SUNY Old Westbury
Dept. OF Mathematics, Computers & Information Science
SCHOOL OF ARTS AND SCIENCE
COMPUTER SCIENCE PROGRAM

COURSE TITLE: Artificial Intelligence

COURSE NUMBER: CS 4400 **MEETS:** Mon & Wed, 9:50-11:30am **Room:** NAB 0109

CREDIT HOURS: 4

INSTRUCTOR: Doyoung Park, Ph.D

OFFICE: NAB 2008

PHONE: 516-628-5642

EMAIL: parkd@oldwestbury.edu

OFFICE HOURS: 4:20-5:50pm on Mon & Wed (or by an appointment)

TERM(S) OFFERED: Fall, 2024

TEXTBOOK:

(Required)

Title: Artificial Intelligence: A Modern Approach (3rd (or 4th) Edition)

Author: Russell and Peter Norvig

Publisher: Pearson

ISBN-10: 0136042597(3rd) / 0134610997(4th)

ISBN-13: 978-0136042594(3rd) / 978-0134610993 (4th)

⇨ More information on the book is found at http://aima.cs.berkeley.edu/

(Recommended)

1) Murphy, Kevin P. Machine learning: a probabilistic perspective, MIT press, 2012. (Available free online)
2) Daphne Koller and Nir Friedman. Probabilistic Graphical Models: Principles and Techniques, MIT Press, 2009.
3) Christopher M. Bishop. Pattern Recognition and Machine Learning, Springer, 2006.

PREREQUISITES: CS 3810: Data Structure & Algorithms, MA 3210: Intro to Probability and statistics

COURSE DESCRIPTION:

This course provides an introduction to artificial intelligence using the intelligent agent paradigm. An intelligent agent is a software system that can interact with an external environment by perceiving that environment and taking actions to change the environment

based on the sequences of percepts received. We will explore the principles and techniques involved in creating intelligent agents that act optimally in complex environments given limited information and computational resources. Topics include search techniques (e.g. heuristic search and local search), knowledge representation and reasoning (e.g. propositional logic, first-order logic, and reasoning under uncertainty), and learning techniques (e.g. decision-tree learning, neural networks, and reinforcement learning).

COURSE OBJECTIVES (LERNING OUTCOMES):

At the conclusion of this course students should be able to:

- Describe the history of AI.
- Discuss philosophical and ethical issues related to AI.
- Explain, implement and apply algorithms in several key areas of artificial intelligence including,
    - State-space search
    - Logic-based knowledge representation and inference
    - Artificial neural networks
    - Probabilistic knowledge representation and inference
    - Markov decision problems and reinforcement learning
    - Natural language processing
    - Robotics and computer vision
- Describe the limitations of existing approaches to AI.
- Describe current applications of Artificial Intelligence.

TOPICS (TENTATIVE):

1. **Overview**: foundations, scope, problems, and approaches of AI.
2. **Intelligent agents**: reactive, deliberative, goal-driven, utility-driven, and learning agents Artificial Intelligence programming techniques
3. **Problem-solving through Search**: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.
4. **Knowledge Representation and Reasoning**: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.
5. **Planning**: planning as search, partial order planning, construction and use of planning graphs
6. **Representing and Reasoning with Uncertain Knowledge:** probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference, sample applications.
7. **Decision-Making**: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

8. **Machine Learning and Knowledge Acquisition**: learning from memorization, examples, explanation, and exploration. learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.
9. **Brief Survey of selected additional topics**: perception, communication, interaction, and action; multiagent systems.

WHAT THE COURSE IS NOT:

This is not a course for learning to program AI games or any full-blown applications. This course is oriented towards algorithms, theories, and mathematics behind modern AI.

INTENDED AUDIENCE:

Undergraduates (seniors), and graduates (masters with non-AI focus)

INSTRUCTIONAL MODALITY(IES): Lecture/Discussion/Labs

ACTIVITIES/ASSIGNMENTS/REQUIREMENTS:

[Exam] There will be a midterm and a final exam. The final exam will focus on material covered after the midterm. Make-up exams will not be given without approval from the professor. Any unapproved absence from an exam will yield a score of zero, no exceptions.

[Assignments] Several homework assignments will be given. I will post the assignments on BrightSpace and discuss them in class. For each assignment, If you submit *m* days later, your maximum grade will 100*(1-0.*m*). For example, if *m*=2, your maximum grade is 100*(1-0.2)=100*0.8=80.

[Quizzes] There will be certain number of pop quizzes during the semester. Those quizzes will be based on contents covered in previous lectures (lectures from the last quiz through the most recent lecture.)

ATTENDANCE:

Class attendance is required and a record of attendance will be kept. If you miss a class it is your responsibility to find out what material was covered in class, what the homework was and if any announcements have been made about the schedule for upcoming exams.

Every attendance to the class will be counted as 3 points. If you come within 5 minutes after the class begins, you will get the whole 3 points. If you come between 5 minutes to 10 minutes after the class begins, you will get 2 points. If you come after 10 minutes, you will get just 1 point. Otherwise, you will get 0 point.

EVALUATION:

Letter grades will be assigned to each student based on a mathematical calculation of the points earned on the homework, projects, quizzes as well as middle and final examinations. The weights of the exams are:

Your final grade in the course will be based on the following:

Assignments (or projects)	35%
Midterm exam	25%
Final exam	30%
Class Participation (and Attendance)	10%

A = [94, 100] **A**$^{-}$ = [90, 93]	**B** $^{+}$ = [87, 89]	**C** $^{+}$ = [77, 79]	**D** $^{+}$ = [67, 69]	**F** = [0, 59]
	B = [84, 86]	**C** = [74, 76]	**D** = [64, 66]	
	B $^{-}$ = [80, 83]	**C** $^{-}$ = [70, 73]	**D** $^{-}$ = [60, 63]	

Note:

1) Any type of cheating/plagiarism in tests or projects will result in a grade of "F".
2) The teaching management tool ***Blackboard*** will be used to post the assignments, collect the submission, communicate and post grades.

TENTATIVE COURSE SCHEDULE:

Sessions / week	Topic	Reading
August Week 1	Introduction and course overview	Chap 1
September Week 2	Intelligent agents	Chap 2
Week 3	Problem-solving agents/ Uninformed searching	Ch 3.1-3.4
Week 4	Informed searching	Ch 3.4-3.6
Week 5	Local search and optimization / Searching with nondeterministic actions/partial observations	Chap 4
October Week 6	Games	Chap 5
Week 7	***Midterm Exam***	Chap 7,8

Week 8	Propositional logic 1 / Propositional logic 2	
Week 9	First-order logic 1/ First-order logic 2	Chap 9
Week 10	Probability and Bayes' rule 1 / Probability and Bayes' rule 2	Chap 13,14
November Week 11	Bayesian Network	Chap 15
Week 12	Utility theory / Markov decision process	Chap 16,17
Week 13	Machine learning	Chap 18
Week 14	Reinforcement learning / Vision and robotics	Chap 21, Chap 24-25
December Week 15	Natural language processing	Chap 22,23
Week 16 & 17	***Final Exam (12/18)***	

POLICY:

- ***Late Assignment***

  For each assignment, If you submit *m* days later, your maximum grade will 100*(1-0.*m*). For example, if *m*=2, your maximum grade is 100*(1-0.2)=100*0.8=80.

- ***Missed Assignments***

  Discuss with the instructor

- ***Missed Examinations***

  Students who miss an exam should contact the instructor as soon as possible. If it is known in advance that an exam will be missed, the instructor should be contacted before the exam.

- ***Phone Use Policy***

  Phones should be switched off during the mid-term and final exams. Phones, especially smart phones with Internet access and camera, are not allowed to be on person during exams

- ***Electronic Device***

  I have no problem with you using computers or tablets to take notes or consult reference materials during class. Tempting though it may be, please do not check e-mail or visit websites that are not relevant to the course during class. It is a distraction, both for you and (more importantly) for your fellow classmates. Please silence your phones and computers when you enter class.

- ***Important Calendar Dates for university courses***

  This course will follow all the university dates published by the university. Students can access those official dates by viewing the university calendar at:
  https://www.oldwestbury.edu/academics/calendar

- ***Incomplete Grade***

  A grade of Incomplete may be assigned when a student has completed and passed a majority of the work required for this course but, for reasons beyond the student's control, cannot complete the entire course. Appropriate documentation should be provided.

  Prior to the end of the semester, students must initiate the request for an "I" grade. The incomplete will only be assigned on the basis of an agreement between the instructor and the student (specifying the work to be completed and establishing a general timeline by which the work will be completed.) Incomplete may NOT be resolved by auditing or registering again in a subsequent offering of the course. The date for the completion of the work may be no later than one month before the end of the subsequent semester. Once the work is completed, the instructor will assign an appropriate academic grade.

- ***Academic Integrity***

  As members of the Old Westbury community, students are expected to adhere to standards of honesty and ethical behavior. Plagiarism and other types of academic dishonesty are condemned at all academic institutions. These acts detract from the student's intellectual and personal growth by undermining the processes of higher learning and the struggle with one's own expression of ideas and information.

  Students are expected to be familiar with the academic standards regarding academic integrity of the University and to uphold the policies in this respect. Students are particularly urged to familiarize themselves with the contents at the website:
  https://www.oldwestbury.edu/sites/default/files/documents/academic-integrity.pdf
  and avoid any behavior that could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

- ***Examinations with Disability Services for Students (OSSD)***

If you have or suspect you may have a physical, psychological, medical or learning disability that may impact your course work, please contact Stacey DeFelice, Director, The Office of Services for Students with Disabilities (OSSD), NAB, 2065, Phone: 516-628-5666, Fax (516) 876-3005, TTD: (516) 876-3083. E-mail: defelices@oldwestbury.edu.

The office will help you determine if you qualify for accommodations and assist you with the process of accessing them. All support services are free and all contacts with the OSSD are strictly confidential. SUNY/Old Westbury is committed to assuring that all students have equal access to all learning activities and to social activities on campus.

- ***BASIC NEEDS STATEMENT***

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support at (516)876-3067 or Student Union 303. The College's Panther Food Pantry offers food and personal care items to the campus community in Student Union 301B. The service is anonymous, OW ID is not required. The Pantry website is https://tinyurl.com/yb36bdxc

- ***COUNSELING RESOURCES***

As a college student, there may be times when personal stressors interfere with your academic performance or negatively impact your daily life. If you or someone you know at this college is experiencing mental health challenges, please call the Counseling and Psychological Wellness Services at 516-876-3053 or email us at counselingcenter@oldwestbury.edu .

We're located at the Student Union, Lower Level, Suite 100, and are open Monday to Friday, 9am to 5pm. All services are entirely free and confidential. Students may choose to receive counseling services either in-person, by phone or via video-chat.

If a crisis situation occurs after hours, contact a Residential Director. The University Police, at 516-876-3333, will also be able to offer assistance. The National Suicide Prevention Lifeline also offers help 24/7, and can be contacted at 1-800-273-8255.

- ***TITLE IX, SEXUAL DISCRIMINATION, HARASSMENT AND VIOLENCE***

SUNY Old Westbury prohibits sexual discrimination, harassment and violence, and will promptly respond to all complaints. The purpose of Title IX is to prevent sex discrimination on campus, address reported assaults and incidents, limit the effects of harassment on the educational environment, and prevent its recurrence. If you or someone you know believes they have been subjected to sexual discrimination, harassment or violence, help is available. To report or for more information please visit https://www.oldwestbury.edu/title-ix, please contact the Title IX coordinator, Deputy Title IX coordinator or University Police at 516-876-3333. Confidential resources and support is also available from the counseling professionals in the Counseling & Psychological Wellness Services department, located in the Student Union Lower Level Room LL100 (off the Rotunda) at 516-876-3053.

- **Stephanie Iaccarino, CRC (Faculty/Staff/Student Reports)**
  Deputy Title IX Coordinator
  Campus Center H-418B
  Phone: 516-876-2740
  Email: iaccarinos@oldwestbury.edu

- ***Writing Center***

  Visit the Writing Center for help brainstorming or organizing your ideas or for feedback on a draft. All services will be offered online for Fall 2020. You can make an appointment for an online session at https://oldwestbury.mywconline.com. Hours: Mondays and Tuesdays, 11am-8pm and Wednesdays and Thursdays, 10am-7pm. Phone: (516) 876-3093.

- ***Technology and Remote Learning***

  Taking online and remote classes can be challenging, and we have several resources to help students adapt.

  Blackboard Orientation: Enter Blackboard itself and click on **Student Center** in the upper right corner.
  MS Teams: See the MS Teams link on the Old Westbury Tutoring page.
  SUNY Online: You can find additional support at https://online.suny.edu/covid19/students/.

  For general questions or problems with technology issues, contact the IT Service Desk at servicedesk@oldwestbury.edu or click on the ITS Support Icon on the portal.