AI for Computer Games

CAP 4053, Spring 2021

Instructor

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Course Description

This course focuses on the development of artificial intelligence within the context of games. Topics include fundamentals as game design and interfaces as well as classical and game-specific topics of AI. The techniques covered include problem-solving algorithms, turn-based game-playing, and behavioral / decision-making techniques used to develop game agents as characters. In this course, we will focus not just on developing intelligent AI systems, but also on systems that develop player interest and engagement to enhance players' experiences.

Course Pre-Requisites / Co-Requisites

Prerequisite: COP 3530

Course Objectives

By the end of the semester, successful students should be able to:

- articulate critical elements of game design and how they are applied in practice
- implement recognized problem-solving algorithms to solve a well-defined problem
- describe how problem-solving algorithms can be applied as decision-making behaviors
- combine simple steering behaviors to create fluid agent movement
- design agent decision-making behaviors using common industry frameworks
- create systems that are tailored for human rationality and expectations

Required Textbooks and Software

There are no require materials for this course. All materials will be provided by the instructor. The College of Engineering requires students to have a mobile computing device (laptop) capable of running Windows. Students are required to bring their mobile computing devices to class for in-class assignments!

Recommended Materials

- Artificial Intelligence for Games, Ian Millington, 2009, 2nd Edition, CRC Press
- The Art of Game Design: A Book of Lenses, Jesse Schell, 2014, CRC Press

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance in classroom sections is mandatory and will be taken each class. Students are responsible of all information (including announcements) presented in class. Students who fail to attend lecture and/or discussion forfeit their opportunity to attend office hours unless the absence is excused by the instructor.

Projects and homework may be submitted late with a cascading deduction: one (1) business day late for 10% penalty; two (2) for 30% penalty; or three (3) for 50% penalty. Quizzes and tests may not be submitted late for credit except with instructor approval for extenuating circumstances. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation from a reputable source. For any planned event (such as a wedding), students must contact the instructor at least two weeks in advance for consideration. Please note that there is no guarantee that requests will be accommodated. Social, networking, and club events are considered at the discretion of the instructor. We will not make personal exceptions.

Grade reviews must be requested within one week of a grade being posted. After two weeks, no grade will be revisited. In the event of a grade review, the entire assignment will be reviewed.

Course Schedule (Dates are Tentative)

Wk	Topics	Quizzes (Thursdays)	Assignment Due
0	Syllabus & History of Game AI	Syllabus	
1	Game Design & AI Fundamentals	History & Design	
2	Knowledge Representation & Basic Search	Fundamentals & Representation	Ex0 (Review)
3	Optimized Search and Graph Types	Basic & Optimized Searches	
4	Hierarchical Path Planning & Other Searches	Graph Searches	
5	Genetic Algorithms & Action Planning	Other Searches & Genetic Alg.	
6	Steering Behaviors	Steering Behaviors**	P1 (Path Planner)
7	Q&A and Midterm Examination	-	Ex1 (Flocking)
8	Gameplaying	-	
9	Decision-Making Basics	Gameplaying	Ex2 (Reversi Minimax)
10	Behavior Trees & Irrational Agents	Decision Frameworks	
11	Utility, Risk, and Rule-Based Systems	Behavioral Mathematics	
12	Neural Networks & Influence Maps	Pattern-Based AI	
13	Q&A and Final Examination	-	P2 (Robocode)
14	Team Project Presentations	-	

Evaluation of Grades

Assignment	Total Points	% of Final Grade
Exercises (3)	70 each	21%
Projects (2)	140 each	28%
Quizzes (11-Drop-1)	20 each	20%
Midterm Exam	120	12%
Final Exam	180	18%
Professionalism	10	1%
Extra Credit Project	30	3%
		103%

Information on UF policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Grading Policy

Percent	Grade	Points
93 - 100	A	4.00
90 - 92	A-	3.67
87 - 89	B+	3.33
83 - 86	B	3.00
80 - 82	B-	2.67
77 - 79	C+	2.33
73 - 76	C	2.00
70 - 72	C-	1.67
67 - 69	D+	1.33
63 - 66	D	1.00
60 - 62	D-	0.67
0 - 59	E	0.00

Final grades will be rounded to the nearest whole percentage point. Grades will not be "bumped up", and no additional credit will be offered at the end of the term – so **do not ask**! Any request for a final grade increase, via "bumping" or "extra credit" **will result in a deduction of 1% of the student's final grade**.

Code Submissions

Functionality is key to success in software development and computer science, so it is **extremely important** that the guidelines are followed. Failure to follow these instructions will result in penalties.

1) Include only and exactly those files specified by the documents in submission. If the project submission has naming or organization error(s), its grade will be **zero (0)**.

2) Code must compile / run in debug and release mode. Students should write unit tests to ensure proper code function before submitting. Debug information should never be released in the final version of a software project. **Projects that do not compile AND run will be marked zero. VERY ZERO. *MUCH NOTHING***. (wow. 😉)

Team Project

In this class, all students are expected to participate in a team project which is due at the end of the semester. This project will be a competitive autonomous agent project and the environment will be released and discussed midway through the course. There is no option for students to work alone on this project.

Professionalism & Expectations

Students are expected adhere to the following guidelines in this course:

Students should act with honor and honesty in all assignments. Sharing / copying, "borrowing" of code structure, discussing code structure, looking at code from another student or providing such code, and plagiarism, in addition to other dishonest behaviors, are all considered academic dishonesty. Absolutely no information regarding assignment solutions may be shared by students except at a conceptual level. If students implement via inspiration from other sources, they must cite those sources. Students may not copy code from the Internet or other sources under any circumstances. Any student found to have violated these rules, whether a provider or receiver or unauthorized help, will be given a zero and referred to the Honor Court. **When in doubt, ask.**

Students should facilitate learning of others without distraction. Students should refrain from watching videos; playing games; talking; sleeping; howling; biting toe nails; and other distracting behaviors during course meetings.

Tests may be reviewed during office hours but will not be distributed. Making good assessments takes time and effort. Unfortunately, some disreputable organizations and companies attempt to compromise tests to give some students an edge for a fee. To combat this, we will always allow students to review tests during office hours, but we will not release them en masse. Do not post information about exam questions in any public or semi-public space, even in class chat!

Students should visit office hours for project help and grade questions. Online students should make plans to chat with a TA during scheduled office hours or try to arrange an appointment with the TA or instructor. Do not send private messages to or tag ("@") instructors or TAs, and do not email instructors or TAs about project help. *Emailed project / exercise questions will not receive a response!* We try to answer questions when possible in chat, but to get personalized help, visit or make arrangements.

Please allow 48 business hours for a response by email and remember that we will not respond to requests for project help. The instructor and TAs have many responsibilities and will respond to messages as is practical, but it can take some time, especially during the busy parts of the term.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Student Privacy
There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Professional Component (ABET)
This course serves criteria (b) of ABET Professional Component, namely: "one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study". This course constitutes one-semester of engineering-specific coursework.

Relation to Program Outcomes (ABET)

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Campus Resources

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.