Purpose

The purpose of this course is to familiarize students with issues and techniques of Artificial Intelligence (AI) for computer games. For nearly 60 years, games have been a standard application area for artificial intelligence techniques. Indeed, some of the earliest AI techniques were designed to play games that humans excelled at: Checkers, Backgammon, Chess, and Go to name a few. While the more general AI goal of “human-level intelligence” has remained elusive, computer scientists have developed techniques that enable computers to play certain games at or beyond the level of the world’s best human players. In fact, many game designers intentionally “dumb down” their AI opponents using techniques such as “artificial stupidity” or “intelligent mistakes” to create game experiences that human players find challenging, rather than impossible.

In this course we will examine both traditional and modern AI techniques that are used in the design of computer games. We will look at techniques for game playing as well as the design of AI opponents tasked with creating “good experiences” for players. The course will begin with a discussion of AI in general, as well as common algorithms, data structures, and representations. From there, we will cover topics in character movement, pathfinding, decision making, strategy, tactics, and learning—all within the context of computer games.

Students will be given three or four multi-week homework assignments, or mini-projects, related to the lecture material. These assignments will require students to implement and/or evaluate some of the algorithms or techniques we are covering during course lectures. In addition, students enrolled in the graduate section of the course will conduct a semester-long project that will be reviewed by students in the undergraduate section of the course. All students will additionally be evaluated with a midterm and a final exam.

Instructor

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Office hours: M/T 1:00-2:00pm, EB2 2254. You are welcome to stop by my office at other times, but I reserve the right not to meet with you even if I’m there.

Teaching Assistant

Justus Robertson
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Office hours: T/Th 9:00-10:00, EB2 1211F and by appointment.
Student Learning Outcomes

By the end of the course, students should be able to accomplish the following:

- Identify aspects of computer games that can benefit from the use of artificial intelligence.
- Evaluate the relative benefits and drawbacks of different artificial intelligence techniques that can be used to solve computer game problems.
- Implement a variety of artificial intelligence and machine learning techniques for traditional and modern computer games.

Text

The text for this course is not required, but it is strongly encouraged that you purchase a copy. This course will cover topics presented in:


Prerequisites

- For CSC495: CSC316.
- For CSC591: Graduate standing in Computer Science, or senior undergraduate standing as a CSC concentrator.

Policies and Procedures

Academic Integrity

Students are required to follow NCSU policy. “Academic dishonesty is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student’s record or academic career” (NCSU Code of Student Conduct). It is the instructor’s understanding and expectation that the student’s submission of any assignment means that the student contributed to the assignment in question (if a group assignment) and that they neither gave nor received unauthorized aid (if an individual assignment). Authorized aid on an individual assignment includes discussing the interpretation of the problem statement, sharing ideas or approaches for solving the problem, and explaining concepts involved in the problem. Any other aid would be unauthorized and a violation of the academic integrity policy. This includes referring to homework from previous semesters. Any computer work submitted must be completed on your own personal computer or from your own NCSU account to avoid confusion about the origin of the files, and no sharing of files in any way is allowed on individual assignments and no inter-group sharing is allowed on group assignments. All cases of academic misconduct will be submitted to the Office of Student Conduct. If you are found guilty of academic misconduct in the course, you will be on academic integrity probation for the remainder of your years at NCSU and may be required to report your violation on future
professional or school applications. More information can be found online at [http://www.ncsu.edu/provost/academic_regulations/integrity/reg.htm](http://www.ncsu.edu/provost/academic_regulations/integrity/reg.htm).

**Homework**

Students will submit homework individually unless otherwise specified in the assignment (see the above section on “Academic Integrity”). The assignments will either be posted on the course webpage or distributed in class. If a student is unable to attend class, it is their responsibility to determine if an assignment was given.

**Homework Grading**

Homework submissions will be graded according to the criteria outlined in the assignment. Missing components or lateness will be penalized accordingly.

**Late Assignments**

Completed assignments should be turned in by the beginning of the class period on the date they are due. For assignments for which email or other electronic submission is requested, the submission should be completed before the start of the class period on the date they are due. Every student has four days which they may allocate to late assignments throughout the semester at a cost of five points per day. Once the allotment of four days has been used, there will be no more late submissions accepted. For example, a student who submits the first assignment three days late (and receives 15 points off of their grade) only has one day remaining for all subsequent assignments.

Valid excuses such as illnesses with a note from a doctor or a death in the family (with documentation) will be granted extensions to deadlines, provided the documentation is presented to the instructor in a timely manner. Other extensions may be granted for other scholarly activities provided arrangements are made with the instructor well in advance of the deadline.

**Exams**

This course will have two exams: a midterm and a final. The midterm will be given in class on 2/21. The final exam is scheduled from 1:00 - 4:00 on Thursday, May 10th.

**Course Project (CSC591 only)**

Students enrolled in CSC591 will be evaluated using a semester-long group project on a topic of their choosing (approved by the instructor). Details about the project, grading desiderata, and deadlines can be found on the course webpage and will be distributed in class well in advance of any deadlines. Students are highly encouraged to work closely with the instructor on their project or to seek a separate faculty mentor. Periodically throughout the semester, students will be asked to present updates on their progress to the instructor.
Course Project Reviews (CSC495 only)

Students enrolled in CSC495 will be expected to write double-blind reviews of project proposals, updates, and final submissions. Students will be assigned 2–3 projects to review throughout the semester and will be graded on the quality of the feedback they provide to project participants. Details about the project, grading desiderata, and deadlines can be found on the course webpage and will be distributed in class well in advance of any deadlines.

Attendance

Attendance at class sessions is not required; however, unexcused absences that result in late assignments or missed announcements may negatively affect students’ grades. Documented medical excuses or other excused absences will not adversely affect grades. Conference travel or other scholarly duties discussed well in advance of a missed session may be excused at the discretion of the instructor.

Class Evaluations

Online class evaluations will be available for students to complete during the last two weeks of the semester. Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructors.

Students with disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 919-515-7653. See also the web page on disability services for students (http://www.ncsu.edu/dso/).

Course Format

This will be a lecture course covering topics in Artificial Intelligence and Machine Learning for computer games. Students will be given three homework assignments throughout the semester. There will be a midterm and a final exam. Students enrolled in the 591 section will conduct a semester-long project implementing an AI technique of their choosing for a computer game of their choosing and will summarize their projects in an eight page paper as well as an in-class presentation. Students enrolled in the 491 section will act as “conference reviewers” for the projects, providing feedback throughout the semester.

Grading

Grades will be computed with a weighted average using the following weights.
For CSC591:
Homeworks (3): 50%
Midterm exam: 10%
Final exam: 20%
Project: 20%

For CSC495:
Homeworks (3): 50%
Midterm exam: 15%
Final exam: 25%
Project reviews: 10%

In addition, there may be opportunities for extra credit throughout the semester. Such opportunities may include attending lectures relevant to course topics, or participating in research studies. Each opportunity will be made available to the entire class and awarded points towards the final grade as determined by the instructor on a case-by-case basis. Students are welcome to suggest extra credit opportunities to the instructor, but no guarantees are made about which will be offered.

Schedule

The schedule is subject to change pending student interests and background. The official schedule will be kept on the course webpage here: [http://www.csc.ncsu.edu/faculty/robertsd/csc591495s12/schedule.php](http://www.csc.ncsu.edu/faculty/robertsd/csc591495s12/schedule.php). The official schedule will be updated periodically to reflect changes as the semester progresses. It is the student’s responsibility to check the schedule regularly for changes. The instructor will communicate any changes in deadlines to students in a timely manner via email and/or announcements in class. Note, it is the student’s responsibility to check their official NCSU email address at least once daily and to come to class. Failure to do so does not excuse missed deadlines.