CS6601: Artificial Intelligence
Fall 2024 Syllabus

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Table of Contents

Class Information

Course Description

CS6601 is a survey of the field of Artificial Intelligence and will often be taken as the first graduate course in the area. It is designed to be challenging and involves significant independent work, readings, and assignments. The course covers most of the required textbook Artificial Intelligence: A Modern Approach 4th edition, which is a keystone of Georgia Tech's Intelligent Systems PhD qualifier exam.

Required Course Readings

The course textbook is Artificial Intelligence: A Modern Approach (AIMA, Fourth edition) by Stuart Russell and Peter Norvig. Note there is a much cheaper CourseSmart edition for "rent." The textbook will be supplemented by several papers whose links will be provided throughout the course.

Competency

To succeed in this course, you should be able to answer 'Yes' to the following questions:

- Are you confident with computer programming in Python?
- Have you taken several classes that required intensive programming?
- Are you familiar with basic concepts of data structures and programming, such as inheritance and O notation?
- Are you familiar with basic concepts of algorithm design, such as algorithms for sorting, searching, and matching?
- Are you familiar with the basic concepts of linear algebra, probability, and single/multi-variable calculus?

If your answer is "No" to any of these questions, this course may not be appropriate for you.

Class Goals

By the end of this course, we hope you achieve the following goals:

- **Foundation:** You should build a strong foundation in classic AI techniques like game playing, search, constraint satisfaction, logic and planning, machine learning, graphical models, etc.
- **Skills:** You should be able to propose, evaluate, and implement solutions to problems requiring AI techniques

- **Integration:** You should be aware of where AI intersects with other disciplines, primarily machine learning and perception.
- **Assessment:** You should have experienced different flavors of problems and solutions, and have developed a taste for some; you should also have confidence in how and where AI can be applied in problems relevant to society.

Class Materials

Course Schedule

CS6601: Artificial Intelligence is typically run as a 16-week class. All assignments are due at the end of the week, on Sunday at midnight UTC-12 (Anywhere On Earth time). This deadline translates to an early-morning Monday deadline in the Americas, a midday Monday deadline in Europe, etc.

The class schedule is available here. This schedule of the lessons is intended as a rough guide. For the midterm you are responsible for all material that has a suggested date prior to the release of the midterm. For the final, everything in the class, including what you learned in your research for the assignments, will be applicable. Each assignment is based on some of the preceding lesson topics and may require additional independent research.

Reading List

Most readings will be from the textbook. Additional readings will be made available either publicly online or will be provided to you in the Resources section for this class.

We will also provide an optional reading list.

Class Assessments

Grade Categories

Your final grade in this class will be based on a couple of components (and some minor ones).

Category	**%**	**Description**
Assignments	60%	Top 5 scores achieved from 6 assignments
Exams	35%	Midterm (15%) and Final (20%)

Plagiarism & Python Introductory Assignment	5%	A quiz designed to inform about plagiarism policies in the class and an assignment to help with the setup of the Python environment.
Extra credit	12%	Throughout the class there will be opportunities to receive extra credit to encourage a deeper, more “research-y” understanding of the material.

It is important to note that this course does not follow the normal grading buckets (90 or above for "A", 80 to 90 for "B", etc.). Make sure to pay attention to the announcements after each assignment is graded to understand where your grade sits in the big picture.

Achieving a final grade above the median will result in an “A”. A “B” will be given for final grades equal to the median and above 1 standard deviation below the median. Final grades equal to or below 1 standard deviation below the median and above 2 standard deviations below the median will get a “C”. Final Grades equal to or below 2 standard deviations below the median and above 3 standard deviations below the median will get a “D”. Any grade equal to or below 3 standard deviations below the median will get an “F”. There will be chances to earn extra credit points during the semester, which will be factored in at the end after all other curving is done, i.e. extra credit points will not contribute to the curves.

It's important to note that curving cannot give you a worse letter grade than the one you would receive under the normal grading buckets, i.e you can guarantee yourself a letter grade “A” by getting a grade above 90, the same applies to other letters (e.g. 80-90 is “B”, etc.).

Although we understand the importance of grades, we encourage you to focus first on doing the best you can; if you do, your grade should take care of itself.

Grading Policies

We strive to return grades within two weeks of submission. Grades will generally be delivered via Canvas.

Note that grades on the last assignment and the final exam will be posted very close to the final grade submission deadline. Make sure to allocate time after finals to check your grades and make sure everything, especially these last two grades, are as you expect.

Lastly, remember: this class is effectively graded on a curve. If you try to interpret your grade according to the traditional categories, you will likely think you are doing worse in the class

than you actually are. Make sure to pay attention to the stats posts at the end of each assignment for the context necessary to interpret your grade and evaluate your performance.

The cutoff for an “A” will be at most 90%. The cutoff for a “B” will be at most 80%. For a “C”, at most 70% etc.

Assignments

There are six assignments in this class. Only the top five grades will be used in determining the final grade; however, we suggest you complete all of the assignments because they will help with your understanding and your performance on the final. Each year, several students’ letter grades would have been higher had they completed the last assignment (which is on your instructor’s favorite topic). Make sure to attempt extra credit sections for each assignment that has it; extra credits will be added on top of your assignment score, even if you scored full marks already.

Note: the top five grades policy will not be applied in cases of academic violation, the zero score grade (in-case of the first academic misconduct) will be enforced as one of the top five grades.

Most assignments will involve programming in Python. You may wonder why we chose Python given that Peter Norvig and Thad Starner both prefer Lisp for teaching AI and that Alan Kay once called Lisp “The greatest single programming language ever designed”? In preparing for this course, the AI instructors surveyed believed Python was the best compromise; it has inherited many good features of Lisp, is commonly used in industry (e.g., Google), and best matches the pseudocode in the book (according to Norvig himself). Students taking a course at this level should be able to become functional in a new language quickly. Please become acquainted with Python.

Below is a summary of the assignments. Due dates can be found on the course calendar.

0. Priority Queue: A simple exercise for familiarization with python and preparation for the next assignment.

1. Search: Experiment with various search techniques to discover the most efficient way to find the shortest path between three places in a city.

2. Isolation Player: Use the MINIMAX and alpha-beta pruning techniques and experiment with evaluation functions to create a program that can play a variant of the game Isolation better than a human.

3. Bayes Nets: Implement Bayesian networks and sampling algorithms to gain a better understanding of probabilistic systems.

4. Decision Trees: Build, train, and test several decision tree models to perform basic classification tasks.

5. Gaussian Mixture models: Implement k-means clustering and Gaussian mixture models to perform basic image segmentation. Research, implement, and test the Bayesian Information Criterion to guarantee a more robust image segmentation.

6. Hidden Markov models: Implement the Viterbi and Forward-Backward algorithm to recognize signals using HMMs.

*More information about the projects and their learning goals will be provided in the individual project assignment pages.

These python assignments are submitted to Gradescope (mandatory) and are auto-graded.

Midterm and Final

There will be a cumulative midterm and final exam in this class. These exams will be take-home and will be open-book, open-note and open video lectures. Further internet use will not be allowed.

The exams will be provided and submitted in PDF format. Gradescope will be used for grading, so students will be able to view their grades and examine the graded PDF for each exam.

Class Policies

Course Communication

Any new class information that you are responsible for knowing (such as changing due dates or changes to assignment requirements) will usually be sent in two ways:

- A Canvas announcement with an email notification.
- A pinned Ed Discussion announcement in the ‘announcements’ folder with an email notification.

Thus, any new information you are required to know should be visible on the Canvas page and Ed Discussion forum for the class. However, Canvas is the official resource for deadlines and information.

If we have any questions for you (for instance if we cannot open your assignment or run your code) we will email you. Georgia Tech generally asks that you check your GT email at least once every 24 hours on weekdays. Although a response within 24 hours is rarely required in this course, we ask that you check your GT email with that level of regularity to make sure you see any important announcements and have plenty of time to respond to any TA questions. If we contact you and do not hear back, your grade may be affected (and we don't want that!).

Note that assignments are due on Sunday nights based on popular request among OMS students. However, **remember that for the instructors and TAs of this class, this is a job and we may not check Ed Discussions on weekends. Please make sure to start the projects and assignments early enough to ask questions in advance.**

Office Hours

Generally speaking, questions should first be posted to Ed Discussions. This opens up the question to input from everyone in the class and creates a self-documenting history of the answer to the question. However, there are certain questions that are better suited for office hours, such as more conversational discussions on course material and discussions about individuals' grades. For these cases, we will have weekly synchronous office hours sessions run via Zoom. A calendar of the available office hours is available here.

Note that generally, these office hours will not be recorded aside from Zoom. Synchronous office hours are intended for conversations, discussions about course material, etc. rather than straightforward question-and-answer; since they tend to be personalized to the individual attendees, they are not as useful when recorded and posted. Additionally, the pressure of knowing that around 300 people may watch a private chat tends to dampen natural conversation. If anything comes up in these office hours that is relevant to the rest of the class, it will be recorded or posted on Ed Discussions. In the event that synchronous office hours are not offered during a time that you can make, please let us know and we'll try to add times to the schedule.

If your question is about a private issue such as a grade on an examination, you should post a private Ed Discussions message (visible only to instructors). Please remember, however, that the instructor and TAs are together responsible for a class of around 300 students in addition

to in-person classes and other responsibilities. Please be patient in awaiting responses and whenever possible, post your questions publicly on the forum first.

Late Work

Running such a large class involves a detailed workflow for assigning assignments to graders, grading those assignments, and returning those grades. As such, work that does not enter into that workflow presents a major delay. Thus, we cannot accept any late work in this class. All assignments must be submitted by the posted deadlines. Only the top N-1 of the N assignment grades will be used to calculate the final grade. Our suggestion is to use that policy wisely and always submit something for each assignment, taking advantage of the policy only in an emergency. If you have technical difficulties submitting the assignment to Canvas, post privately to Ed Discussions immediately and attach your submission.

If you have an emergency and absolutely cannot submit an assignment by the posted deadlines, we ask you to go through the Dean of Students' office regarding class absences. The Dean of Students is equipped to address emergencies that we lack the resources to address. Additionally, the Dean of Students office can coordinate with you and alert all your classes together instead of requiring you to contact each professor individually. You may find information on contacting the Dean of Students with regard to personal emergencies here.

The Dean of Students is there to be an advocate and partner for you when you're in a crisis; we wholeheartedly recommend taking advantage of this resource if you are in need. Justifiable excuses here would involve any major unforeseen disruption to your classwork, such as illnesses, injuries, deaths, and births, all for either you or your family. Note that for foreseen but unavoidable conflicts, like weddings, business trips, and conferences, you should complete your work in advance. If you have such a conflict specifically with the midterm or final, let us know and we'll try to work with you.

Collaboration & Academic Honesty

In general, we strongly encourage collaboration in this class. You are encouraged to discuss the course material, the exercises, the written assignments, and the projects with your classmates, both before and after assignments are due.

However, collaboration should be at the "white board interaction" level. We draw the lines as follows:

- You may not copy any code directly from anyone else. To this end, you are explicitly prohibited from looking at public GitHub repositories for the purposes of the assignments (including the book's own python repositories & code implementations). **If you are looking at someone else's code**, whether it be that of a fellow student or a public GitHub repository, **you are cheating**. This **includes pseudocode** shared on the web or by classmates; you may only use pseudocode provided by the book or the teaching staff. In this regard, we are emulating the rules of behavior in corporate environments like Google. Looking at other people's code can and will be considered equivalent to plagiarism. You may use others' ideas to inform your own designs, but your project must be your own work.
- You may not post your assignment code on a public platform such as GitHub. Please use a private repository (available free through Georgia Tech) if you wish to use git.
- You may not directly copy any text from anyone else's written assignments. This includes paraphrasing. Again, you may use others' ideas to inform your own writing, but your assignments must be your own work.
- You may not collaborate with anyone at all on the midterm or final. Do not discuss or share the questions and answers with your classmates or any other parties until after the tests are due.

The program has mechanisms in place to prevent plagiarism. We enlist the help of OMSCS students in detecting such cases and will act upon any evidence that we find. We have successfully caught instances of plagiarism each semester. Please don't be the next person; we can assure you that the consequences for a poor grade are far, far less impactful than the consequences for plagiarism. It is not worth the risk. Any instances of violation of this policy will be referred to the Dean of Students, initiating a lengthy resolution process. If you are unsure of whether a certain type of collaboration is acceptable, please ask first, preferably on Ed Discussions. The full Georgia Tech honor code is available here.

Feedback

We continually experiment with 6601, and there are bound to be things we can (and will) improve. First, we ask that you be patient and understanding with anything that might go wrong; we promise that we, too, will be fair and understanding, especially with anything that might impact your grade or performance in the class. Second, we ask you to give us feedback on anything that we could be doing better, as well as feedback on anything you are particularly enjoying. You may take advantage of the suggestion box on Ed Discussions (or email the Professor and the TAs).

Diversity and Inclusion

Georgia Tech values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are usable, equitable, inclusive and welcoming. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify the instructor as soon as possible. Students with disabilities should contact the Office of Disability Services to discuss options of removing barriers in this course, including accommodations. ODS can be reached at 404.894.2563, dsinfo@gatech.edu, or at disabilityservices.gatech.edu.