CS6601: Artificial Intelligence Spring 2016 Syllabus

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Class Information

Teaching Team

[Thad Starner](#)

Creator, Instructor
([thad[at]gatech.edu](thad[at]gatech.edu))

Shelly Bagchi

Lead Teaching Assistant
([shelly.bagchi[at]gmail.com](shelly.bagchi[at]gmail.com))

Murtaza Dhuliawala

Teaching Assistant (Assignment 1)
([murtzdhulz[at]gmail.com](murtzdhulz[at]gmail.com))

Saurabh Agarwal

Teaching Assistant (Assignment 4)
([saurabh9209[at]gmail.com](saurabh9209[at]gmail.com))

Ashita Prasad

Teaching Assistant (Assignment 3)

(prasad.ashita[at]gmail.com)

Naman Goyal

Teaching Assistant (Assignment 2)

(naman.goyal21[at]gmail.com)

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 involve significant independent work, readings, and assignments. The course covers most of the required textbook Artificial Intelligence A Modern Approach 3rd 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, Third 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?

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

Class Goals

The goals of this course are
- **Foundation:** Having a strong foundation in classic AI techniques like game playing, search, constraint satisfaction, logic and planning, machine learning, graphical models, etc.
- **Skills:** Being able to propose, evaluate, and implement solutions to problems requiring AI techniques.
- **Integration:** Being aware of where AI intersects with other disciplines, primarily machine learning and perception.
- **Assessment:** Experiencing different flavors of problems and solutions, and developing a taste for some; having 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.   For ease of use, you may want to set your T-Square timezone to UTC-12.

The class schedule is available here. This schedule of the lessons is merely provided as a guide. For the midterm you are responsible for everything that has a suggested date before the midterm is given. 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 immediately preceding lesson topics and may require additional research on your own.

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 T-Square 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 two components.

Category	%	Description
Assignments	60%	top 5 scores achieved from 6 assignments
Exams	40%	Midterm and final

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 and project is graded to understand where your grade sits in the big picture. Achieving a grade *above* the mean will result in an "A." A "B" will be given for final grades *equal to* the mean and *above* two standard deviations below the mean. Grades *equal to or below* two standard deviations below the mean and *above* three standard deviations below the mean will get a C. Any grade *equal to or below* three standard deviations below the mean will get an F. 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 will strive to return grades within two weeks of submission. Grades will generally be delivered via T-Square.

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 (May 6) to check your grades and make sure everything, especially these final two, are as you expected.

Lastly, remember: this class is effectively graded on a curve. A 90% is certainly not the threshold for an A in the class. Last semester's class average was 85%, and only 25% of the class ended with a raw score over 90; half the class still received an A, though. 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.

Assignments

There are six assignments in this class. *Only the five top 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 midterm and final. In the last class at Georgia Tech, several students' letter grades could have been higher if they had completed the last assignment (which is on your instructor's favorite topic).

Most assignments will involve programming in **Python**. Why Python when Peter Norvig and Thad Starner both prefer Lisp for teaching AI, and Alan Kay 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.

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

Computer Isolation Player: Using MINIMAX and alpha-beta pruning and experimenting with evaluation functions, create a program that can play the game Isolation better than a human.

Tri-directional search: Experiment with various search techniques to discover the most efficient way to find the shortest path between three cities.

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

Building Trees & Forests: Build, train, and test several decision tree models to perform basic classification tasks.

Gaussian Mixtures: 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.

HMM Recognition: Implement the Viterbi and Forward-Backward algorithm to recognize signals using HMMs.

More information about the projects and their learning goals will be found on the individual project assignment pages.

Midterm and Final

There will be a midterm and final in this class. We are still determining the format and best way to administer them.

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 be sent in two ways:
- A T-Square announcement with an email notification.
- A pinned Piazza announcement in the 'announcements' folder with an email notification.

Thus, any new information you are required to know will arrive in your inbox twice, as well as be visible on the T-Square page and Piazza forum for the class.

If we have any questions for you, such as your assignment could not be opened or your project would not run, we will email you. Georgia Tech generally asks that you check your GT email at least once every 24 hours on weekdays. While there should not be anything in this course that requires an answer that fast, we ask that you check your GT email with that level of regularity to make sure you see any important announcements in plenty of time and respond to any TA questions quickly. 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 Piazza on weekends. Please make sure to start the projects and assignments early enough to ask questions in advance.

Office Hours

Generally speaking, questions should be posted first to Piazza. 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, like more conversational discussions on course material and discussions about individuals' grades. For these things, we will have weekly synchronous office hours sessions run via Google Hangouts, as well as Instructor Hangouts on Air. A calendar of the available office hours times is available [here](#).

Note that generally, these office hours will not be recorded aside from Instructor Hangouts on Air. Synchronous office hours are intended for conversations discussions about course material, etc. rather than straightforward question-and-answer; because they are more personal to the individual attendees, they are not as useful when recorded and posted. Additionally, the pressure of knowing 200 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 Piazza. In the event that synchronous office hours are not offered during a time that you can make, 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 Piazza message (visible only to instructors). Please remember, however, that the instructor and TAs are together responsible for a class of 200 students in addition to in-person classes and other responsibilities, so 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 T-Square, post privately to Piazza **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 line at the following:

- You may not copy any code directly from anyone else. Again, 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 directly paraphrasing. Again, you may use others' ideas to inform your own writing, but your assignments must be your own work.
- You may not collaborate at all on the midterm or final. Do not discuss the questions and answers with your classmates until after the tests are due.

The program has mechanisms in place to prevent plagiarism and has caught instances of it each semester. Please don't be the next person; I assure you that the consequences for a poor grade are far, far less than the consequences for plagiarism. It isn't worth the risk. Any instances of violation of this policy will be referred to the Dean of Students. If you are unsure of whether a certain type of collaboration is acceptable, please ask first, preferably on Piazza. The full Georgia Tech honor code is available [here](#).

Feedback

Spring 2016 is the first time we are delivering this course as part of the Georgia Tech Online Master's in Computer Science. It is a new experience for us, and as such, 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 Piazza (or email the Professor and the TA).