CS7637: Assignment 4 (Summer 2016)

Due: June 26th at 11:59PM UTC-12 (Anywhere on Earth time)
Complete **either** Assignment 3 **or** Assignment 4; do not complete both. Submit your assignment via T-Square.

Assignment: Addressing Difficult Problems

First, choose one of the following nine real-world tasks that AI is tackling today. Remember, in all these cases, the goal is to design an artificially intelligent agent that can accomplish the task, not to accomplish it ourselves as humans.

- Solving human intelligence tests (the Raven's Progressive Matrices test, the n-back test, the Odd One Out test, or others). How would you design an agent that can perform well on a human intelligence test while also taking the test like a human?
- Driving and navigating a car on an open roadway with other vehicles. How would you design an agent that can drive itself, react to stimuli around it, and navigate to the desired destination? (You may assume the car is already built with the necessary sensors, etc.)
- Designing new recipes. IBM has created Cognitive Cooking, a system that designs new recipes. How would you create an agent that can intelligent design new recipes?
- Learning new skills by observing humans. Tesca Fitzgerald and others are working on designing robots that can observe humans completing a task and learn to complete the task themselves, flexibly (for example, understanding that the motion used to lift a cup can be used to lift a mug). How would you design an agent that can learn in this manner?
- Designing new sustainable solutions inspired by biology. Engineering new systems is historically a creative human enterprise, but Ashok Goel and others are working on agents that can intelligently make sense of biological systems and design new technologies based on that biology. How would you design an agent that can do this?
- Installing and running oneself on new software architectures. Rodney Brooks characterized a number of big AI problems. One is that biological organisms can adapt to new environments, but software agents presently cannot. How would you design an agent that can intelligently adapt itself to new software environments?
- Playing chess like humans play rather than using deep search techniques. Rodney Brooks noted that while AI agents are very good at chess, they succeed through deep search in a sort of brute force method; they do not play by chunking, strategizing, and learning like humans do. How would you create an AI agent that plays chess more like a human does?

- Adjusting to rule changes and devising new strategies autonomously. Joshua Jones and others are working on designing game-playing agents that can intelligent adapt when the rules of a game are changed. For example, an AI agent playing Chess would be able to intelligently change its strategy if a rule was made allowing the King to move two spaces. How would you design an agent that could do this?
- Teaching a new skill to a human. The intelligent tutoring systems community aims to build AI agents that can teach skills, like Calculus, Physics, or higher-level skills like scientific reasoning and self-regulated learning. How would you design an agent that can tutor a human on a skill of your choice?

Then, choose one (or more) of the following four topics. In a response of roughly 1000 words, answer the question: how would you use this topic or these topics to address the problem you chose above? You may also feel free to incorporate topics covered previously in the course.

- Common Sense Reasoning
- Scripts
- Explanation-Based Learning
- Analogical Reasoning

1000 words is neither a minimum nor a maximum, but rather a rough guideline to the amount of thought needed to adequately answer the question. You may feel free to write more, or write less if you feel you can answer the question in less text. You are also free and encouraged to augment your description with pictures, diagrams, drawings, sample problems, or any other visual aid to support your answer.

Submission

The assignment should be submitted as a PDF. Most modern word processors allow you to save a document as a PDF. If yours does not, we recommend copying or uploading your assignment to Google Docs and downloading it as a PDF. There also exist other freely-available PDF converters online.

To submit the assignment, go to the assignment submission page, upload your document, and click submit. All submissions must be received by the due date and time. Late work will **not** be accepted, although we have built in a little lag time in T-Square to account for slow upload times. Please see the syllabus for more information on the course late policy.

Grading

Your assignment will be graded according to eight criteria. Each criteria will be evaluated on a scale of 0 to 5:

- How well does the assignment describe the problem it is attempting to solve?
- How well does the assignment identify what makes the problem difficult?
- How well does the assignment articulate its design for a solution to the problem?
- How well does the assignment leverage the chosen topic or topics in designing that solution?
- How well does the assignment explain how the chosen topic or topics address what makes the problem difficult?
- How well does the assignment expand on the description of the topic or topics that was presented in the lecture? In other words, how well does the assignment demonstrate understanding of the topic, not just repetition of its vocabulary?
- How well does the assignment supply enough depth and detail to be able to actually implement a system based on this idea?
- How well does the assignment actually solve the problem? Is the solution proposed by the assignment feasible?

Thus, assignments will be scored out of 40. It is important to note that a 90% should not be considered the threshold for an "A". Make sure to check the stats posts at the conclusion of each assignment to see the class distribution and understand your grade.

Peer Feedback

After each assignment, you'll be asked to give peer feedback to three other students in the class via Peer Feedback. You'll receive your peer review assignments the day after the assignment is due, and you'll have until the following Sunday to submit your peer feedback. Peer review is worth 15% of your grade, and your participation in peer review will be graded based both on completion of the activities and on the quality of your feedback, as judged by both the TAs and your peers.

You will receive three peer review assignments for *every* assignment, *whether you chose to complete that assignment or not*. So, make sure to complete peer review on all six assignments in the course, including the three that you yourself do not choose to do.