Stats 232C: Cognitive Artificial Intelligence

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Recommended Requisites: Stats 232A, Stats 232B

Justification
As the studies of both human cognition and artificial intelligence develop rapidly, the gap between them widens. While human mind is adapted to function under “the poverty of stimuli”, modern AI typically draws its power from “big data”. This course will bridge this gap by introducing recent discoveries of human mind, and formalizing them as rigorous statistical models.

Course Objectives
(1) Understanding the strengths and weakness of mainstream AI from a statistics perspective.
(2) Introducing latest findings from cognitive science that are valuable for artificial intelligence.
(3) Demonstrating how to formalize observations of human behavior as statistical models.
(4) Developing AI systems that can capture aspects of human intelligence.

Course Description
The course will demonstrate how to build artificial intelligence by following principles of human intelligence revealed by cognitive science. These principles include (a) learning from small data; (b) expressing causality of the physical world; (c) inferring others’ mental states for intuitive social interactions. To achieve this goal, this course requires tools drawn from statistical modeling, cognitive science, artificial intelligence, computer vision, and robotics.

Topics & Tentative Schedule
Below is a tentative schedule of the course with weekly topics:
• Week 1. Understanding human mind statistically.
• Week 2. Growing strong AI from babies
• Week 3. “One and only one” –Achieving human-like one-shot learning
• Week 4. Perceiving causality from correlation
• Week 5. Human mind as an approximated physics engine
• Week 6. “To a man with a hammer, everything is a nail” --Tools and functionality
• Week 7. It is alive! --Visual roots of social cognition
• Week 8. “Do androids dream of electric sheep?” --Social psychology of robots
• Week 9. Beautiful mind(s) --Game theory and Multi-Agent Interactions
• Week 10. Student project presentations

Assignments
There will be weekly reading assignments. There will also be a final project for building a statistical model inspired by human cognition.

Grading
Final grade of this course is composed of three parts:
1. Reading assignments (30%)
2. Midterm exam (20%): Open-book, in-class
3. Final project (50%): Group of no more than three students