

Artificial Intelligence Methods for Social Good

M0- I: Introduction

08-537 (9-unit) and 08-737 (12-unit)

Instructor: Fei Fang

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Wean Hall 4126

What is AI?

- ▶ AI in our daily lives
 - ▶ Web search (Google, Bing)
 - ▶ And...

- ▶ AI lead to transformation and evolution in domains and industries
 - ▶ Finance (Loan, Insurance)
 - ▶ And...

What is AI?

- ▶ Founders: “Intelligence can be so precisely described that a machine can be made to simulate it”
- ▶ What’s your definition of AI?

Brief History of AI

▶ Early days

- ▶ Founded in 1950s: Allen Newell (CMU), Herbert Simon (CMU), John McCarthy (Stanford), Marvin Minsky (MIT)
- ▶ Single agent / deterministic
 - ▶ Play chess, prove theorems, solve puzzle
 - ▶ Logics and symbolic systems, heuristic reasoning, search
- ▶ Integrated AI systems
 - ▶ Perception→learning/reasoning/planning→action

▶ AI winter (1990s)

- ▶ Over-optimism→Over-pessimism
- ▶ Interact with real world: uncertainty, multi-agent, real time
- ▶ Easy for human, hard for AI: object recognition, understand speech
- ▶ New tools from decision theory, optimization, game theory etc

New Era of AI

- ▶ Why?
 - ▶ Increasing computer power
 - ▶ And...
- ▶ Success of AI
 - ▶ Image classification
 - ▶ And...

Branches of AI

- ▶ Machine learning
- ▶ And...

How AI impact Society

- ▶ **Benefits of AI to society**
 - ▶ Reduce human labor
 - ▶ And...
- ▶ **Concerns of AI to society**
 - ▶ Job loss
 - ▶ And...

Artificial Intelligence Methods for Social Good

Module 0-2: Logistics

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Instructor and TA

- ▶ Instructor: Fei Fang (feifang@cmu.edu)
 - ▶ Office Hour: Tue/Thu 1pm-2pm or by appointment
 - ▶ Wean 4126

- ▶ TA: Chun Kai Ling (chunkail@andrew.cmu.edu)
 - ▶ Office Hour: Wed/Fri 2pm-3pm or by appointment
 - ▶ GHC 6507

Basic Info

- ▶ Some overlap with other AI courses (quick poll)
 - ▶ 15-381/781: AI; 15-780: Graduate AI
 - ▶ 10-701/15-781: Machine Learning; 10-715 Advanced Introduction to Machine Learning
 - ▶ 05-499/899: Computing for Good
 - ▶ 10-725/36-725: Convex Optimization; 10-703 Deep Reinforcement Learning or 10-707 Topics in Deep Learning; 10-708 Probabilistic Graphical Models

Basic Info

- ▶ This course
 - ▶ Broad coverage of AI methods
 - ▶ Recent advances applied to address societal challenges
 - ▶ In depth experience with one topic through course project
- ▶ Pre-requisite
 - ▶ (9 unit and 12 unit) Linear algebra, probability, calculus
 - ▶ (12 unit) Programming experience, basic AI

Basic Info

- ▶ **AI methods covered:**
 - ▶ Optimization: mathematical programming, robust optimization, influence maximization
 - ▶ Game Theory and Mechanism Design: security games, human behavior modeling, auction and market equilibrium, citizen science
 - ▶ Machine Learning: classification, clustering, probabilistic graphical models, deep learning
 - ▶ Sequential Decision Making: Markov Decision Processes (MDPs), partially observable MDPs, online planning, reinforcement learning
- ▶ **Societal challenges tackled:**
 - ▶ Healthcare
 - ▶ Social welfare
 - ▶ Security and privacy
 - ▶ Environmental sustainability

Class Format

- ▶ Modules focused on AI methods
 - ▶ Concepts, basic algorithms
 - ▶ May use white board heavily (please take notes or pictures)
- ▶ Modules focused on applications
 - ▶ Advanced techniques applied to address societal challenges
 - ▶ 8 guest lectures by distinguished researchers
- ▶ Paper discussion
- ▶ In-class quizzes (through Piazza)

Learning Objective

- ▶ Identify societal challenges, determine which AI methods can be applied
- ▶ Describe the AI methods: concepts, models, algorithms, implementation
- ▶ Model the societal challenges and propose how to apply AI techniques
- ▶ Describe evaluation criteria and methodologies of applying AI methods for social good
- ▶ Deliver written and oral presentation

Learning Objectives (Alternative Description)

- ▶ For lectures on methods:
 - ▶ Understand the part highlighted on the white board
 - ▶ Know where to find other useful information
- ▶ For lectures on applications:
 - ▶ Get a brief idea about the advanced techniques and the applications
- ▶ For course project:
 - ▶ Pick one topic and go in depth

Grading

Course Component	Weight	Expected Workload
Class participation	10%	3 hours/week
Paper Summaries	20%	2 hours/week
Written Answers Assignment	20%	1 hour/week
Final Project	50%	3 hours/week for 08-537 6 hours/week for 08-737

- ▶ Final Grade: Letter graded

Grading Criteria Overview

- ▶ **Class participation**
 - ▶ In-class quizzes (use Piazza or hand in on paper)
 - ▶ Asking and answering questions in class/on Canvas
 - ▶ Can skip up to 4 lectures
- ▶ **Paper reading assignments**
 - ▶ 14 assignments, No late days, Lowest score dropped
 - ▶ Submit: Summary + Questions + Brainstorming Ideas (peer reviewed)
- ▶ **Written Answers Assignment**
 - ▶ 8 assignments, No late days, Lowest score dropped
 - ▶ Submit: Answers (three attempts, auto-graded) + Explanations (peer reviewed)
 - ▶ Bonus score for best explanations

Grading Criteria Overview

▶ Final Project

- ▶ In groups of 1-3. Allow to have team members from both sessions. Grading follow criteria of 08-737 if any member is from 08-737
- ▶ Due Dates
 - ▶ Determine group members, due 2/1
 - ▶ Project Proposal (5 points), due 2/15 (peer-reviewed)
 - ▶ Project Progress Report (5 points), due 3/20 (peer-reviewed)
 - ▶ Project Presentation (15 points), In class of 5/1 and 5/3
 - ▶ Full Project Report (25 points), due 5/10

Resources

- ▶ Course webpage
 - ▶ <https://feifang.info/artificial-intelligence-methods-for-social-good-spring-2018/>
- ▶ Canvas
 - ▶ <https://canvas.cmu.edu/>
 - ▶ Questions, discussion, homework, grade
 - ▶ For all course content-related questions, please post on Canvas instead of writing emails to instructor/TA
- ▶ Piazza
 - ▶ Access through Canvas
 - ▶ Or <https://piazza.com/class>
 - ▶ Only for in-class quizzes

Textbook and Additional Reference

- ▶ No formal textbook
- ▶ List of additional resources will be provided (check Canvas and slides)

Waitlist

- ▶ We are trying our best to get everyone in!

Academic Integrity

- ▶ Be collaborative, give credits
 - ▶ If discuss with others, specify names and complete on your own
- ▶ Leverage resources
 - ▶ If use publicly available code packages, specify source
- ▶ If your complete submissions (including explanations) are the same, you will get zero score and the case will be reported
- ▶ Course project report should follow standard academic integrity policy. Plagiarism is not allowed.
- ▶ See CMU policy on academic integrity for general information
 - ▶ <https://www.cmu.edu/student-affairs/ocsi/academic-integrity/index.html>

Special Needs

- ▶ If you have a disability and require accommodations, please contact Catherine Getchell, Director of Disability Resources, 412-268-6121, getchell@cmu.edu
- ▶ If you have an accommodations letter from the Disability Resources office, discuss with me as early as possible

Student Well-Being

- ▶ Start early! Avoid last-minute panic.
- ▶ CMU services are available, and treatment does work
- ▶ <http://www.cmu.edu/counseling/>
- ▶ 412-268-2922

Mobile Device Policy

- ▶ Mobile devices are allowed in class
- ▶ Cellphones should be in silent mode
- ▶ Students who use tablet in upright position and laptops will be asked to sit in the back rows of the classroom

Homework for today

- ▶ **Complete HW0 on Canvas**
 - ▶ 0 point in final grade, unlimited trials, full score is required
 - ▶ Due 1/25
 - ▶ Probability, linear algebra, and calculus
 - ▶ Logistics
 - ▶ Course project idea
- ▶ **Complete the poll on Piazza**
 - ▶ Indicate your interest (not anonymous)
 - ▶ 0 point in final grade, required
 - ▶ Due 1/25
- ▶ **Start finding group members (check the poll result)!**

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Spring 2018

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Artificial Intelligence Methods for Social Good

Module 0-3: Course Project Overview

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Expectations

- ▶ You are expected to get a deep understanding of one topic of AI through the course project
- ▶ You are expected to learn how to identify and model real-world challenges as problems that AI methods can apply
- ▶ You are expected to make your results public to benefit others (e.g., submit paper to workshops, make code package available on GitHub etc)
- ▶ You are not expected to build an app with user interface etc (although it is good to have for some projects)

Different Types of Projects

▶ 9-unit

- ▶ Systematic literature review (no coding needed)
 - ▶ Application-centric
 - “AI Methods for Reducing Poverty”
 - ▶ AI method-centric
 - “Deep Learning for Social Good”
 - ▶ AI method + Application -centric
 - “Game Theory for Anti-Poaching”
- ▶ Exploratory project
 - ▶ Data-centric
 - “Detecting Mining Sites from Satellite Imagery Using Faster R-CNN”
 - ▶ Model/algorithm-centric (no coding needed although encouraged)
 - “Optimizing Inspection Strategy to Reduce Air Pollution”
 - ▶ Solver/code package-centric
 - “A Python Package for Solving Security Games”

Different Types of Projects

▶ 12-unit

▶ Research project

- ▶ Data-centric
- ▶ Model/algorithm-centric

▶ For Ph.D. students: recommended to talk to your Ph.D. advisor and choose a project that is related to your research

Course Project Topics

- ▶ A list of suggested project topics is available (check Canvas, complete poll on Piazza)
- ▶ Can propose your own projects topics related to AI and Social Good, need consent from the instructor
- ▶ Even if you plan to work on a suggested project topic, try to propose one topic to enlighten other students (HW0)

Course Project Advisor

▶ Advisor

- ▶ Faculty advisor is not required, will not be assigned
- ▶ Encouraged to reach out to faculty members / senior students / domain experts, ask for feedback and advice (which papers to read, learn what happens in practice etc.)
- ▶ May invite them to serve as faculty advisor or serve on the advisory board
- ▶ For suggested course project topics A-L, I would like to provide guidance during office hours