Syllabus: Disrupting Healthcare with AI

Credits: 1   **Prerequisites**: knowledge of Python recommended

Location: CSIC 2118   **Class Time**: Fridays 2:00pm - 2:50pm

Course Facilitators: Sanna Madan – smadan12@umd.edu
                          Kyle Liu – kliu1234@umd.edu

Faculty Advisor: Dr. Max Leiserson

Office hours: TBD

Textbook: None

Course Description

The goal of this course is to introduce students to the numerous opportunities for disrupting healthcare with cutting edge methods in artificial intelligence (AI) and data science. The class will consist of engaging code labs, thought-provoking discussions, exploration of groundbreaking industry work in the space, and hands-on exposure to the specific challenges of the century. Ideal if you want to increase your AI knowledge and ability to apply it towards real social problems. Emphasis on creativity, brainstorming, and coming up with your own solutions to relevant problems. By the end of this course, students should be able to understand how to effectively apply machine learning methods to real healthcare datasets.

Topics Covered

- Overview of AI (machine learning vs. deep learning vs. neural networks)
- Precision medicine for diseases such as cancer and dementia
- Cancer immunotherapy
- Early detection of disease (*e.g.*, liquid biopsy)
- Electronic Health Records (EHRs)
- Telemedicine
- AI in the mental health space (*e.g.*, virtual therapy, diagnosis, etc.)
- Major startups and companies in the space
- Combatting regulatory and ethical issues

Grading

Component	Percent	Description
Codelabs	40%	We will provide relevant datasets and ask you to write code to analyze them and/or make interesting tools. Lots of freedom - get creative!
Quizzes	20%	In class quizzes based on readings from the previous week or in-class slides/lecture.
Final Project + Demo	40%	Final project to demonstrate mastery of all topics learned and apply knowledge to analyze a self-chosen dataset from scratch.

Proposed Course Timeline

Week # (Dates TBD)	Topic	Activities	HW
1	Introduction to AI	Go over AI, machine learning vs. deep learning vs. neural nets vs. deep vision, etc., and the usefulness of different models.	Machine learning code lab
2	Mental health	Discuss applications of AI to the mental health space. Can we use AI to diagnose mental disorders? Are virtual therapists going to be a thing?	Quiz 1
3	Case study: Mental Health	Andrew Ng's Woebot	Codelab 1 OUT
4	Precision + personalized medicine - cancer	Discuss/explore advancements in treating cancer with AI. Targeted therapies, immunotherapy, and predicting response to treatment.	Quiz 2
5	Precision + personalized	Discuss/explore advancements in treating neurological diseases,	Codelab 1 DUE, Codelab 2 OUT

	medicine - neurological diseases	*e.g.*, dementia, with AI. Early detection, personalized medicine, and development of treatments.	
6	Designing effective drugs with AI	Explore how drug target identification and drug development are being sped up with AI.	Quiz 3
7	Case Study: designing effective drugs with AI	Exploration of current advancements in the space in industry.	Codelab 2 DUE, Codelab 3 OUT
8	Early disease detection	Explore the world of diagnostics - liquid biopsies, imaging, genetic testing, etc.	Quiz 4
9	Case Study: early disease detection	Grail, Freenome, Theranos, ethical issues	Codelab 3 DUE, Codelab 4 OUT
10	Electronic Health Records	Can we predict emergency room visits, predict patient outcomes, and more? We'll explore this hands-on with data. How can we improve hospital care?	Quiz 5
11	Case Study: EHRs	Flatiron health	Codelab 4 DUE
12	Project Overview	Explain project, Give some examples of potential data sets	Final Project OUT
13	Review & Potential Guest Speaker	Review material & invite someone working in the space to give a talk	
14	Final Project Demo	Share final project in class	Final Project DUE

Faculty Advisor Information

Professor Max Leiserson
Max Leiserson is a computer scientist and computational biologist. His main research interests are in developing and applying algorithms and statistics to understand the genetics of cancer. He was a graduate student with Ben Raphael in Computer Science and Computational Biology at Brown University, and was a postdoctoral researcher at Microsoft Research, New England.

Outside-of-class communication with course staff

We can be reached through in-person office hours or via email. See above section for emails.

Excused absence and academic accommodations

See the "Attendance, Absences, or Missed Assignments" section of UMD's Course Related Policies.

Disability support accommodations

See the section titled "Accessibility" available at Course Related Policies.

Academic integrity

Note that academic dishonesty includes not only cheating, fabrication, and plagiarism, but also includes helping other students commit acts of academic dishonesty by allowing them to obtain copies of your work. In short, all submitted work must be your own. Cases of academic dishonesty will be pursued to the fullest extent possible as stipulated by the Office of Student Conduct.

It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit: http://www.shc.umd.edu.

Course Evaluations

If you have a suggestion for improving this class, don't hesitate to tell the course staff during the semester in-person, over email/Piazza, or through the weekly feedback surveys. At the end

of the semester, please don't forget to provide your feedback using the campus-wide CourseEvalUM system. Your comments will help make this class better.