

Teaching

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AI Health

Spring 2020

Course Information

Course Date and Time: Thursday 12:00-3:00PM
 Location: UTA 1.204
 Instructor: Ying Ding
 Office Hour: Thursday 10-11:45AM, or by appointment

Course Description

Recently, the U.S. healthcare industry has surpassed manufacturing and retail to become the largest employer in the country, with every 1 out of 8 Americans working in this sector. Policies and incentives have been established to promote IT in health to improve care and delivery. In this course, we will explore the major components of health IT systems, ranging from data semantics (ICD10), data interoperability (FHIR), diagnosis code (SNOMED CT), to workflow in clinical decision support systems. After establishing the good understanding of the fundamentals of health IT systems, we will dive deep into how AI innovations (e.g., machine learning, deep learning, computer vision) are transforming our healthcare system by introducing new concepts of mobile health, AI diagnosis, AI medicine, smart device, and intelligent delivery. This course will offer hands-on tutorials based on the real-world Electronic Health Record (EHR) data from MIMIC III (<https://mimic.physionet.org/>) released by MIT Critical Data. MIMIC-III (Medical Information Mart for Intensive Care III) contains de-identified health information from over forty thousand patients who stayed in critical care units of the Beth Israel Deaconess Medical Center between 2001 and 2012. These tutorials aim to enhance data search and analytics skills by providing practices related to database search, natural language processing, data visualization, machine learning, and deep learning. In this course, we will enhance the group learning experience and learning by doing, therefore, there will be many class activities. This course is designed for everyone, so no tech or programming background is required or desired.

Course Objectives

After attending this course, you should be able to achieve the following goals:

- Be aware of current healthcare initiatives to deliver quality care
- Understand the basic technologies of health IT systems including data semantics, data interoperability, workflow, and diagnosis
- Be familiar with electronic health record systems (EHR systems)
- Gain the overview of AI innovations in healthcare
- Master practical skills of data search and analytics including database search, natural language processing, data visualization, machine learning, and deep learning

Calendar

Week	Lecture	Class Activity	Lab/Tutorial	Notes
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W1	Introduction	knowing each other	working together	Get access to MIMIC III
W2	Quality Care	paper discussion, case report	Download MIMICIII	Form a group
W3	Evidence-based Care	Paper discussion, case report	T1: MIMIC-SQL	Form a group
W4	EMR Semantics I: ICD	paper, case, hero, market, group	T2: MIMIC- Python and SQL	
W5	EMR Semantics II: SNOMED CT	paper, case, hero, market, group	T3: MIMIC-NLP I	case report due
W6	EMR data sharing: FHIR	paper, case, hero, market, group	T4: MIMIC-NLP II	hero report due
W7	Clinical Decision Support System	paper, case, hero, market, group	T5: MIMIC-machine learning I	market report due
W8	AI health I: Machine Learning/Deep Learning	paper, group	T6: MIMIC-mahcine learning II	NLP tutorial due
W9	AI Health II: mobile health	paper, group	T7: MIMIC-deep learning	
W10	AI health III: imaging	paper, group	T8: knowledge graph - node2vec	
W11	AI health IV: smart device	book chapter, presentation	T9: knowledge graph-edge2vec	
W12	AI in medicine	group project	T10: Data visualization I	
W13	Future AI health	Group project	Group project	DataVis tutorial due
W14	Final presentation	group project demo	group project deom	book chapters due
W15	Final report due	demo/poster session		final report due

Homework and Grading

Individual Assignments (45%)

- 1. Case report (5%): find a case related to AI health, describe the details about this case, and layout your thoughts and critics.
- 2. Write about your hero (5%): identify a professional in the area of healthcare, read at least 3 of his/her writings, write the summary of his work, your thoughts, whether you want to recommend him/her as our guest speakers. If he or she decides to come, can you do the interview before his/her talk).
- 3. Market report on a selected domain (5%): (e.g., chronic disease management, tele medicine, enterprise portals for EMR, smart medical devise, chatbot for healthcare, smart diagnosis, well-being and health, smart medical apps, hospital management system, health insurance, etc.) including: the list of players, market summary, business model, product review, pros and cons, your business intelligence about this domain).
- 4. NLP Tutorial (10%): generate a NLP tutorial using MIMIC datasets (powerpoint slides, code, video).
- 5. ML/DL tutorial (10%): generate a ML/DL tutorial using MIMIC datasets (powerpoint slides, code, video).
- 6. Data Visualization tutorial (10%): generate a data visualization tutorial using MIMIC datasets (powerpoint slides, code, video).

Group Assignments (15%):

- 1. Book Chapter writing (15%): Chapter 1: Evidence-based Care, Chapter 2: AI health - Imaging, Chapter 3: AI health - mHealth, Chapter 4: AI Health and Future; Chapter 5: AI health Ethics. Appendix I: Hero Project,

Appendix II: Market intelligence; Appendix III: Case Studies

- 2. Group Project (30%): Build evidence-based care apps/tools,
 - joining AI Health Data Challenge
 - using MIMIC datasets
 - data+design
 - a 3-5 page report (aiming for a workshop paper), powerpoint, demo, code, and video (assuming that you will teach it to other students), presentation

Class presentations, participations, and final presentation, book chapters (10%).

Grading Guideline

Your written, web-based, and oral work will be evaluated according to four criteria; it must:

- Be clearly written, marked up, and/or presented, and checked for spelling and grammar;
- Demonstrate a degree of insight into the concepts, issues, and trends in both the areas you investigate in the assignments and in the course content;
- Demonstrate a degree of originality in your reviews, analyses and projects; and
- Display familiarity with the appropriate literature.

To receive a passing grade in this course, you must turn in all of the assignments and the term project and complete all the presentations. You cannot pass this course without doing all of the assigned work (which includes the final presentation), however, turning in all of the work is not a guarantee that you will pass the course.

Borderline grades will be decided (up or down) on the basis of class contributions and participation throughout the semester.

A	4.0	Outstanding achievement. Student performance demonstrates full command of the course materials and evinces a high level of originality and/or creativity that far surpasses course expectations.
A-	3.7	Excellent achievement. Student performance demonstrates thorough knowledge of the course materials and exceeds course expectations by completing all requirements in a superior manner.
B+	3.3	Very good work. Student performance demonstrates above-average comprehension of the course materials and exceeds course expectations on all tasks as defined in the course syllabus.
B	3.0	Student performance meets designated course expectations and demonstrates understanding of the course materials at an acceptable level.
B-	2.7	Marginal work. Student performance demonstrates incomplete understanding of course materials.
C+	2.3	Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course materials.
C	2.0	
C-	1.7	Unacceptable work. Coursework performed at this level will not count toward the MLS or MIS degree. For the course to count toward the degree, the student must repeat the course with a passing grade.
D+	1.3	
D	1.0	
D-	0.7	
F	0.0	Failing. Student may continue in program only with permission of the Dean.