

HEALTH INFORMATICS

From medical centers and individual physicians adopting electronic medical records, to patients keeping track of chronic diseases through websites and apps, we live in an era of unprecedented access to health data. These data enable inference of drug side effects, causes of disease, and new treatments, but the new terminologies, policies, and challenges in understanding the data itself can make it difficult for computational researchers to apply their techniques to this new area and for health professionals to begin using informatics to solve practical problems. This course will give both groups the foundation needed to propose, evaluate and develop projects such as secondary analysis of health data and will enable them to begin effective interdisciplinary collaborations. Students will learn how health data is collected (in both hospital and non-hospital settings), how the structure of record systems impacts the research process and interpretation of results, and how to design and evaluate studies involving secondary use of health data (while complying with HIPAA and IRB regulations) in order to gain new medical knowledge and improve healthcare delivery.

Prerequisites None. The course is intended for advanced undergraduate and graduate students from computer science and other disciplines.

Text There is no required textbook. Readings are articles that will be provided.

Evaluation Discussion of the readings is an important part of the course and will count towards the final grade. It is not possible to succeed in this course without participating. There will be a final project (and presentation), as well as one presentation for the journal club assignment and discussions of case studies.

Grades will be: 10% homework, 15% participation, 25% midterm exam, 50% final project.

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Office hours are Monday 2-2:45pm and by appointment.

Lecture Monday 3-5:30pm

Schedule

Below is the weekly schedule of topics, readings for each session, and deadlines. All journal articles will be available electronically through the library or in Canvas. Readings may change, but in that case an announcement will be made in class.

- 1/23 Introduction to health informatics. Overview of field, relation to bioinformatics
- 1/30 Where and why is health data collected? (including meaningful use and PPACA). Including claims data, clinician-generated data, and information exchange.
- P. Wicks, T. E. Vaughan, M. P. Massagli, and J. Heywood. Accelerated clinical discovery using self-reported patient data collected online and a patient-matching algorithm. *Nature biotechnology*, 29(5):411–414, 2011 [\[pdf\]](#)
- 2/6 What are the data? EMRs, PHRs, and data standards (narrative vs. structured data, ontologies)
- S. Abhyankar, D. Demner-Fushman, F. M. Callaghan, and C. J. McDonald. Combining structured and unstructured data to identify a cohort of icu patients who received dialysis. *Journal of the American Medical Informatics Association*, 1 2014 [\[pdf\]](#)
- 2/13 Cancelled
- 2/22 Ethics in biomedical research. HIPAA, IRBs, and de-identification. We will discuss the rules and regulations governing health research and, from a practical standpoint, how to preserve privacy when conducting research
- E. Vayena, R. Brownsword, S. J. Edwards, B. Greshake, J. P. Kahn, N. Ladhner, J. Montgomery, D. O’connor, O. O’neill, M. P. Richards, et al. Research led by participants: a new social contract for a new kind of research. *Journal of medical ethics*, 2015 [\[html\]](#)
- 2/27 Data reuse and evaluation challenges (what is a diagnosis really?)
- S. Kleinberg and N. Elhadad. Lessons learned in replicating data-driven experiments in multiple medical systems and patient populations. In *AMIA Annual Symposium*, 2013 [\[pdf\]](#)
 - IRB proposals due
- 3/6 Midterm exam
- 3/20 Research with EMR data, Introduction to MIMIC dataset
- F. Doshi-Velez, Y. Ge, and I. Kohane. Comorbidity clusters in autism spectrum disorders: an electronic health record time-series analysis. *Pediatrics*, 133, 2014 [\[pdf\]](#)
- 3/27 Methods for evaluation. How can we compare systems and determine if a project is successful?
- M. Ghassemi, J. Marshall, N. Singh, D. J. Stone, and L. A. Celi. Leveraging a critical care database: selective serotonin reuptake inhibitor use prior

to ICU admission is associated with increased hospital mortality. *CHEST Journal*, 145(4):745–752, 2014 [\[html\]](#)

- Project proposals due

4/3 Pharmacovigilance and drug discovery

- R. W. White, N. P. Tatonetti, N. H. Shah, R. B. Altman, and E. Horvitz. Web-scale pharmacovigilance: listening to signals from the crowd. *Journal of the American Medical Informatics Association*, 2013 [\[pdf\]](#)

4/10 Journal club discussion of recent papers in health informatics

4/17 Decision Support

- P. J. O’Connor, J. M. Sperl-Hillen, W. A. Rush, P. E. Johnson, G. H. Amundson, S. E. Asche, H. L. Ekstrom, and T. P. Gilmer. Impact of electronic health record clinical decision support on diabetes care: a randomized trial. *The Annals of Family Medicine*, 9(1):12–21, 2011 [\[pdf\]](#)

4/24 Public health, epidemiology, and mobile health

- M. Rabbi, M. H. Aung, M. Zhang, and T. Choudhury. Mybehavior: automatic personalized health feedback from user behaviors and preferences using smartphones. In *Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, pages 707–718. ACM, 2015 [\[pdf\]](#)

5/1 Presentations of final projects

- Written project reports due