
CS 792

INTRODUCTION TO HEALTH INFORMATICS AND DATA STRUCTURE

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DESCRIPTION

This course focuses on health data as a key component of all health informatics systems. Topics include architecture of electronic health records, ontologies and other classification taxonomies found in health systems, data standards and data exchange framework, technology for capturing, storage and usage of health data, and privacy and security regulations governing the appropriate use of health data.

COURSE OVERVIEW

This course provides an overview of major health informatics topics. The focus is on health data types, standards, methodologies and technologies to properly handle the health data. Challenges associated with health informatics applications and emerging trends and technologies are also discussed. The course is taught via a combination of online and in class lectures and hands-on practices of designing and implementing a health informatics solution to solve a real world problem.

The lectures cover the following topics

- Health data types and format
- Security and privacy protection standards and ethics of using health data
- Terminology standards including international, national and domain specific standards.
- Electronic health record data model and information architecture
- Imaging informatics and standards
- Health data exchange framework
- Structure/non-structure health data and Natural language process
- Clinical knowledge presentation and decision support
- Health data analytics and future trend

LEARNING OUTCOMES:

At the end of the course, students should be able to:

1. **Identify** major health data types and its applications in public health and healthcare
2. **Describe** data models and standards for electronic medical records and health data exchange
3. **Propose** health informatics ideas, designs and functionalities using proper languages and methods
4. **Question** the feasibility and impact of information technology in relation to socioeconomic benefits and health information protection
5. **Appraise** health informatics research or technology solution
6. **Design** and prototype a health informatics solution to meet a real-world health data need

MATERIALS AND RESOURCES

TEXTBOOK(S) REQUIRED

- No required textbook.

RECOMMENDED READING

- Shortliffe, E. H., L. E. Perreault, G. Wiederhold, and L. M. Fagan. *Medical Informatics: Computer Applications in Health Care and Biomedicine*. 4th ed. New York, NY: Springer, 2013. ISBN: 978-1-4471-4473-1; ISBN 978-1-4471-4474-8 (eBook).
Shortliffe is considered the "father of HI". He is one of those MDs with a PHD in computer science. The book provides a good overview on the major topics in biomedical informatics field.
- Benson, T., **Principles of Health Interoperability HL7 and SNOMED**, 2nd ed. 2012, ISBN 978-1-4471-2800-7
This book is a good read for understanding the interoperability and standardization. It provides an easy introduction to HL7.
- Taylor, Paul, **From Patient Data to Medical Knowledge**, 2006, ISBN 978-0-7279-1775-1
This book is an easy read for understanding the medical knowledge representation and clinical decision support.

OTHER MATERIALS

The following major HI standards are accessible on the web. If you want to incorporate them into your project, you can download some portion of computable specifications on a UW repository. This repository will also host

some de-identified health data for research/education purposes. You will be provided with the access the repository after the course starts.

- HL 7 Standards (<https://www.hl7.org/implement/standards/index.cfm?ref=quickLink>)
- Integrating the Healthcare Enterprise (IHE) (<http://www.ihe.net/Profiles/>)
- SNOMED Clinical Terms <http://www.ihtsdo.org/snomed-ct/>
- DICOM (<http://www.dclunie.com/dicom-status/status.html>)
- ICD 10-CM (<http://www.cdc.gov/nchs/icd/icd10cm.htm>)
- ICD 10 – CA
(http://www.cihi.ca/cihi-ext-portal/internet/en/document/standards+and+data+submission/standards/classification+and+coding/codingclass_icd10)
- Health Canada Drug Product Databases
(<http://www.hc-sc.gc.ca/dhp-mps/prodpharma/databasdon/index-eng.php>)

ASSESSMENT:

There are 8 graded assessments in this course. A brief description of each assessment and grade breakdowns are listed below:

1. Online Quiz 1: (5%) –on security and personal health information protection regulations and practices to demonstrate their understanding of HIPPA/PIPEDA standards.
2. Online Quiz 2 (5%) – on clinical terminology standards, including SNOMED, MeSH and ICDx
3. Online Quiz 3: (5%) – on health standards to demonstrate their understanding of HL7 and openEHR.
4. Online Quiz 4: (5%) – on medical imaging standards to demonstrate their understanding of DICOM and PACS systems and IHE framework.
5. Assignment 1 (20%) - Literature Review: Students will conduct investigation on a selected HI research topic, present the state-of-the-art report in a recorded presentation, provide a list of key references on the topic, and write a critique on one key literature of the subject.
 - a. Presentation
 - b. Reference List
6. Assignment 2 (20%) – Project Proposal: A group of 2-3 students will write a proposal for funding to support their innovation in health informatics
7. **Assignment 3-1** (15%) – Project and Demo: The team will design and implement a prototype system according to their grant proposal. The prototype system will be demonstrated in 2 live sessions, one in-class and one Adobe Connect session.
 - a. Design
 - b. Implementation and demo
 - c. Presentation and QA

Assignment 3-2 (15%) – Documentation: produce documentation on the design and functionality of your prototype

Assignment 3-3 Critique and Evaluation (10%)

Assignment 3-3-a (5%) Critique of project demo and presentation

Assignment 3-3 b (5%) Peer assessment of individual contribution to the project

COURSE SCHEDULE

Week	Title	Activities and Assignment	Begin Date	End Data	Weight (%)
Week 1	Health Informatics: Past, Current and Future Trend	Reading and start literature review	Jan. 3	Jan. 5	
Week 2	Privacy, Security and Ethics Consideration in Health Informatics	Quiz 1 (privacy, security and ethnical use of health data)	Jan. 8	Jan. 12	5
Week 3	Standards for Clinical Terminologies	Quiz 2 (Terminology)	Jan. 15	Jan. 19	5
Week 4	EHR Data Models	Assignment 1: Literature Review	Jan. 22	Jan. 27	20
Week 5	EHR Conceptual Information Architecture	Quiz 3 (HL7 and openEHR)	Jan. 29	Feb. 3	5
Week 6	Medical Knowledge Representation and Application	Form project team and start proposal	Feb. 5	Feb. 10	
Week 7	Unstructured Health Data and Natural Language Processing	Assignment 2: Project Proposal	Feb. 12	Feb. 16	20
Reading Week					
Week 8	Imaging and Structured Informatics	Project consultation	Feb. 26	Mar 2	
Week 9	Health Informatics Exchange Framework (IHE)	Quiz 4 (DICOM and IHE)	Mar 5	Mar 9	5
Week 10	Reflect	Project consultation	Mar 12	Mar 16	
Week 11	From Data to Knowledge: health data analytics and decision support	Project team work	Mar 19	Mar 23	
Week 12	Project Demo	Assignment 3-1: Project Demo Assignment 3-3-a Peer evaluation	Mar 26	Mar 30	15 5
Week 13	Documentation and Evaluation	Assignment 3-2 Documentation Assignment 3-3-b Contribution evaluation	Apr 2	Apr 6	15 5

