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 the architecture of electronic health records, clinical terminologies and other classification taxonomies found in health systems, data standards and data exchange framework, technology for capturing, storing and using 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 handle the health data properly. Challenges associated with health informatics applications, emerging trends and technologies are also discussed. The course is taught via a hybrid format, allowing 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 their 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

- Benson, T., Grieve, G, **Principles of Health Interoperability, SNOMED, HL7 and FHIR**, 4th Edition, 2020, Springer, Print ISBN 9783030568825, eBook ISBN- 9783030568832

  This book contains practical instructions for understanding interoperability and standardization. It provides introductions to SNOMED, HL7, and now widely used FHIR standards.

- Shortliffe, E. H., Cimino, J.J., *Biomedical Informatics: Computer Applications in Health Care and Biomedicine*. 5th ed. New York, NY: Springer, 2021. ISBN: 978-3030587208.

  The book provides a good overview of the major topics in the biomedical informatics field. You can access the book here

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.

- HL7 FHIR (http://fhir.org/)
- 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)
- International Classification of Diseases 11th Revision ICD 11-CM (https://icd.who.int/en)
- ICD-10-CA/CCI (ICD code for Canadian Data Reporting)
  (https://www.cihi.ca/en/submit-data-and-view-standards/codes-and-classifications)
- 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. **Quizzes**

   a. **Online Quiz 1** (5%) – on clinical terminology standards, including SNOMED, MeSH and ICDx

   b. **Online Quiz 2**: (10%) – on health information model of electronic health record and privacy protection.

   c. **Online Quiz 3**: (10%) - on health data exchange standards to demonstrate understanding of HL7 (FHIR).

   d. **Online Quiz 4**: (5%) – on medical imaging standards to demonstrate their understanding of DICOM and PACS systems.

2. **Assignment 1** (20%) - Literature Review: Students will investigate 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

3. **Assignment 2** (15%) –Proposal: A group of 2-3 students will write a proposal to support their innovation in health informatics

4. **Assignment 3-1** (25%) – Final Project: 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 (10%) – Documentation: produce documentation on your research findings or the design and functionality of your prototype

COURSE SCHEDULE

Week	Title	Activities and Assignment	Weight (%)
Week 1	Health Informatics: Past, Current and Future Trends	Assignment 1 starts: a literature review	
Week 2	Standards for Clinical Terminologies	Quiz 1 (Terminology)	5
Week 3	Privacy, Security and Ethics Consideration in Health Informatics	Assignment 1 - continue	
Week 4	EHR Conceptual Information Architecture	Quiz 2 (EHR Information Model and Privacy),	10
Week 5	Health Data Exchange Standard (HL7)	Quiz 3 (HL7/FHIR) Assignment 1 Due	10 (Q3) 20 (A1)
Week 6	Medical Knowledge Representation and Application	Assignment 2: Project Proposal	
Week 7	Imaging and Structured Informatics	Quiz 4 (DICOM)	5
Week 8	Unstructured Health Data	Proposal due	
Week 9	Health Informatics Exchange Framework (IHE)	Proposal feedback and revision	15
Week 10	Reflect	Project consultation	
Week 11	Health data analytics and decision support	Project teamwork	
Week 12	Project Presentation/Demo (Demo or Research findings reports)	Assignment 3-1: Project Demo	25
Week 13	Research Findings/Reports	Assignment 3–2 Documentation	10