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SPECIALIZED CERTIFICATE IN DIGITAL HEALTH:

Data Science for Digital Health Syllabus

**Course 2: Data Science for Digital Health**

Course Number: GLBH-40021

Section ID: 143854

Course Start Date: 01/06/2020

Course End Date: 03/29/2020

**Instructor Information**

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Communication Policy: Contact me for immediate response Tuesdays 10:00-11:30pm PST

**Welcome**

Welcome to the Data Science Digital Health online course. I hope you're as excited as I am to explore all the ways that Data Science can be used to advance health care, improve outcomes, and even save lives! Don't worry if you've never used statistics to predict the future or programmed a deep learning model using a programming language like python. We'll show you how to use whatever tools you are familiar with to take advantage of all the amazing developments in Data Science. You can use a spreadsheet program like Libre Office or Excel. And if you prefer to automate your work, you'll see how to use the python language open source tools to go even further, implementing state of the art Data Science and Machine Learning models. Regardless of your tool choice, you will come away from this course with an ability to teach machines how to find patterns in data and learn new things yourself about medicine and health care from those patterns.

**Course Description and Goals**

This is the second course of the Digital Health Specialized Certificate. The course has been crafted by experts with deep experience in applying data science to health care. And because this field is evolving so rapidly, we prepared this material in an \*agile\*, just in time fashion. And you will be able to contribute your ideas and experiences during this course to help us improve it and keep it up to date.

**Course Purpose and Prerequisites**

Intended for those with a background or interest in healthcare transformation, data science, eHealth, public health, IT administration, engineering and regulatory affairs.

**Course Objectives**

Upon completion of this course, the student will be able to:

* Build a strong foundational knowledge of the impact of Digital Health on the healthcare ecosystem;
* Apply critical thinking to understand the evolving Digital Health industry;
* Recognize and assess different opportunities for innovation and disruption in the digital health sector;
* Describe the multi-disciplinary Digital health domain and navigate the different roles of healthcare providers, behavioral psychologists, data scientists, technologists, social scientists, and public health professionals

**Course Materials/Textbooks**

**Course Overview**

This course has 10 sessions. The topics are as follows:

Session 1: **Lecture 1: Data Science in Healthcare**

Session 2: **Lecture 2: Spreadsheet Data Science**

Session 3: **Lecture 3: Statistics, Privacy, Ethics**

Session 4: **Lecture 4: Clinical Data Science & Machine Learning**

Session 5: **Lecture 5: Natural Language Processing**

Session 6: **Lecture 6: Deep Learning, Computer Vision**

Session 7: **Lecture 7: Bioinformatics, Genomics**

Session 8: **Lecture 8: Assistive Technology**

Session 9: **Lecture 9: Hospital and Healthcare System Modeling**

Session 10: **Lecture 10: Public Health & Epidemiology**

**Online Course Structure**

The course is organized using the course menu:

* **Announcements:** This is the first page you see upon entering your course. Your instructor will post weekly announcements and reminders here.
* **Introduction:** Contains an introduction to the course and instructor biography.
* **Syllabus:** Contains the course outline, learning objectives, weekly assignments and course details.
* **Lessons:** This section will have the instructor’s weekly audio/image lectures. The lectures are self-paced and can be replayed anytime like a video or movie.
* **Discussion Board** Questions pertaining to each lesson are posted weekly for you and your classmates to discuss and answer.
* **Assignments:** Exercises will include python programming assignments in Jupyter notebooks (online resources provided) for data manipulation, visualization, and predictive analytics). Quizzes and a final exam will allow you to measure your progress and reinforce your learning. You will also be able to provide feedback to the instructor and university in a course evaluation.
* **Resources:** Additional readings and handouts, web site links, and PowerPoint presentations are provided here.

**Technical and Policy Memo**

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| **Week** | **Assignments** | **Points** |
| 0 | **View lecture 0: Introduction to Course and Certificate**  Assignment #1: Discussion Board | Discussion board: **5 points** |
| 1 | **View lecture 1: Data Science in Healthcare**  Assignment #2: Discussion Board: Share at least one possible (exogenous) cause of growth rate variability in guinea pig birth weight besides litter size.  **RR1:** *The Book of Why: The New Science of Cause and Effect* – Chapter 2 “From Buccaneers to Guinea Pigs” **RR2:** *Data Science for Healthcare: Methodologies and Applications* – p. 3-35 “Data Science ... Opportunities” **SR1:** *Intuition Pumps and Other Tools for Thinking* by Daniel Dennet p. 19-57 (pumps 1-12) | Discussion board: **5 points** |
| 2 | **View lecture 2: Spreadsheet Data Science**  Assignment #3: Discussion Board: Share a real world application of Bayes Rule and show how to apply it.  **RR3:** *The Book of Why: The New Science of Cause and Effect* – Chapter 3 “From Evidence to Causes”  **RR4:** *Data Science for Healthcare: Methodologies and Applications* – p. 39-56 “Classification Algorithms...”  **SR2:**  Simple Linear Regression by Jason Brownlee: [bit.ly/ucsd-sheet](http://bit.ly/ucsd-sheet) | Discussion board: **5 points** |
| 3 | **View lecture 3: Statistics**  Assignment #4: Discussion Board and Quiz  **RR5:** *The Book of Why: The New Science of Cause and Effect* – Chapter 4 “Confounding or Deconfounding”  **RR6:** *Data Science for Healthcare: Methodologies and Applications* – p. 57-72 “Classification Algorithms...”  **SR3:** Jupyter Notebook Tutorial by Karlijn Willems:[bit.ly/ucsd-jup](http://bit.ly/ucsd-jup) | Discussion board: **5 points**  Quiz: **20 points** |
| 4 | **View lecture 4: Clinical Data Science & Machine Learning**  Assignment #5: Discussion & 4 diabetes prediction models  **RR7:** *The Book of Why: The New Science of Cause and Effect* – Chapter 6 “Paradoxes Galore” **SR:** | Project: **20 pts** (5 ea.)  Discussion board: **5 points** |
| 5 | **View lecture 5: Deep Learning and AI**  Assignment #6: Discussion Board  **RR:** “Artificial intelligence in healthcare: past, present and future” Jiang et al: bit.ly/ucsd-ai-survey **RR:**  **SR:** *Natural Language Processing in Action,* Lane et al – Ch 5 “Baby Steps with Neural Networks” | Discussion board: **5 points** |
| 6 | **View lecture 6: Hospital Performance Modeling**  Assignment #7  **RR:** *Data Science for Healthcare: Methodologies and Applications* – p. 347-365 “Leveraging Financial Analytics..”  **SR: “**Modeling Organizational Deerminant of Hospital Mortality”, Al-Haider and Wan 1991, [bit.ly/ucsd-hosp1991](http://bit.ly/ucsd-hosp1991)  **SR:** *Biomedical Informatics,* Shortliffe et al – Ch 12 “EHR” | Discussion board: **5 points**  Quiz: **20 points** |
| 7 | **View lecture 7: Population Health (Epidemiology)**  **RR:** *The Book of Why: The New Science of Cause and Effect* – Chapter 5 “The Smoke-Filled Debate”  **RR:**  **SR:** *Biomedical Informatics,* Shortliffe – Ch 15 “Pub Health” | Discussion board: **5 points** |
| 8 | **View lecture 8: Assistive Tech, Privacy and Ethics**  **RR:** *The Book of Why: The New Science of Cause and Effect* – Chapter 7 “Beyond Adjustment”  **RR:**  **SR:** | Discussion board: **5 points** |
| 9 | **View lecture 9: Natural Language Processing**  **RR:** *Data Science for Healthcare: Methodologies and Applications* – p. 147-165 “NLP with DL”  **RR:** *Data Science for Healthcare: Methodologies and Applications* – p. 173-193 “Reminiscent Therapy...”  **RR:** *Data Science for Healthcare: Methodologies and Applications* – p. 239-265 “...Persuasive Dialogs”  **SR**: *Natural Language Processing in Action* by Lane et al – Chapter 6 “Word Vectors”, 9 “LSTM”, 10 “Seq to Seq”  **SR:** *Biomedical Informatics,* Shortliffe et al – Ch 8 “NLP” | Discussion board: **5 points** |
| 10 | **View Lecture 10: Bioinformatics and Genomics**  **RR: “Biopython tutorial”**  **RR: “Contribution of GWAS...”** by Mansiaux et al, 2012, [bit.ly/ucsd-gwas](http://bit.ly/ucsd-gwas)  **SR:** Intuition Pumps and Other Tools for Thinking by Daniel Dennet p. 185-217 (pumps 33-37 Tools about Evolution) | Discussion board: **5 points**  Policy and Technology Memo Instructions: **90 points** |