∃ Course Map

Course Name: Analytics and AI for Health Strategies, DH 5160, 500-level	
Instructor:	**Date:** June 5, 2024
Designer Name: Jasmine Liang	**Version:** Draft 1

Course Learning Outcomes:

Course description: Structured query language (SQL), power BI/Tableau BI, R/Python, machine learning, and artificial intelligence (AI) to analyze exercise and health data. Data analytics applications and health systems, data mining and visualization, predictive modeling for health outcomes.

Pre-requisites: Admission to DH (or related online MS) program; credit or concurrent enrollment in Foundations of DH, credit or concurrent enrollment in Research Methods and Ethics of Health Technologies, or permission of Program Director.
Grading method: A-F
Offered: F/SP/SU

Learning objectives:

I. Analyze exercise and health data using: Structured Query Language (SQL), Power BI/Tableau BI, and R/Python, machine learning, or artificial intelligence
II. Apply data analytics, visualization, and mining in health systems and healthcare
III. Apply predictive modeling with health outcomes and health behaviors
IV. Utilize business intelligence tools to enhance exercise and health strategies
V. Apply machine learning techniques to analyze and derive insights from health related data, enabling data-driven decision making in the context of exercise and health strategies

Course Materials

Textbooks: (optional) *The Pragmatic Programmer: Your Journey To Mastery, 20th Anniversary Edition (2nd Edition)*
https://valsec.barnesandnoble.com/w/pragmatic-programmer-the-david-thomas/1141787014

Resources:
GeeksforGeeks
https://www.geeksforgeeks.org/
GitHub
https://github.com/

Softwares Requirement:
- MySQL (or your preferred platform)
- Jupyter Notebook / PyCharm / VS Code (or your preferred IDEs)
- R Studio
- Microsoft PowerBI
- Tableau Student https://www.tableau.com/academic/students
- Azure Machine Learning – Automated machine learning

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
Module 1 Introduction to Data Analytics in Health	**I,II,III ,IV,V**	**– Learning Objective:** 1.1 Understand the role of data analytics in health systems. 1.2.Get an overview of health data types and sources. 1.3 Learn about the course structure and expectations. 1.4 System setup **(CLOs I,II,III,IV,V)**	**Quiz:** MCQs for couses understanding and expectation **Assignemnt:** Answer series of short answer questions **Project:** Write a reflection on how data analytics can improve health outcomes, citing examples from current health systems **(MLOs 1.1, 1.2, 1.3)**	Post a mini discussion relating to bigdata and it's application in healthcare field on GitHub for extra credit.	Module 1 on Canvas Optional: Textbook Chapter I
Module 2 SQL	**I**	Basics of Structured Query Language (SQL) **– Learning Objective:** 2.1 Introduction to SQL and its importance in data analysis. 2.2 Learn basic SQL commands (SELECT, INSERT, UPDATE, DELETE). 2.3 Understand how to query health-related databases. **(CLOs I)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Perform basic SQL queries on a provided health database to extract specific data points.	Create own repo on GitHub at upload your project for extra credit	Module 2 on Canvas Optional: Textbook Chapter I

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
			(MLOs 2.1, 2.2, 2.3)		
		Advanced SQL Techniques – Learning Objective: 2.4 Master advanced SQL commands (JOINs, subqueries, indexes). 2.5 Optimize queries for performance. 2.6 Apply advanced SQL techniques to complex health data scenarios. **(CLOs I)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Complete a series of advanced SQL exercises involving JOINs and subqueries on a health database. **(MLOs 2.4, 2.5, 2.6)**	Create own repo on GitHub at upload your project for extra credit	
Module 3 Python	**I**	Introduction to Python – Learning Objective: 3.1 Get an overview of Python 3.2 Set up the development environment (Jupyter Notebook) 3.3 Basic Python Syntax: Familiarize students with Python's syntax, including variables, data types, operators, and basic control structures like loops and conditionals. 3.4 Understanding Data Types: Ensure students understand fundamental data types in Python such as integers, floats, strings, lists, tuples, and dictionaries, along with operations associated with each data type. 3.5 Control Flow: Teach students how to use control structures like if statements, for loops, and while loops to control the flow of their programs and make decisions based on conditions. Function Definition: Introduce students to the concept of functions in Python, including how to define and call functions, pass arguments, and return values.	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** A python cashier game **(MLOs 3.1, 3.2, 3.3, 3.4, 3.5)**	Create own repo on GitHub at upload your project for extra credit	Module 3 on Canvas Optional: Textbook Chapter II

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
	I, II	Python for Data Analysis – Learning Objective: 3.6 Get an overview of Python for health data analysis. 3.7 Write basic scripts for data manipulation. **(CLOs I,II)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Write a script in Python to clean and prepare a health data set for analysis. **(MLOs 3.6, 3.7)**	Create own repo on GitHub at upload your project for extra credit	
Module 4 R	**I**	– Learning Objective: 4.1 Get an overview of R 4.2 Set up the development environment (RStudio) 4.3 Basic R Syntax: Familiarize students with R's syntax, including variables, data types, operators, and basic control structures like loops and conditionals. 4.4 Understanding Data Types: Ensure students understand fundamental data types in Python such as integers, floats, strings, lists, tuples, and dictionaries, along with operations associated with each data type. 4.5 Statistic review **(CLOs I)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Write a script in Python to clean and prepare a health data set for analysis.	Create own repo on GitHub at upload your project for extra credit	Module 4 on Canvas Optional: Textbook Chapter III

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
			(MLOs 4.1, 4.2, 4.3, 4.4, 4.5)		
	I,II	R for Data Analysis - Learning Objective: 4.6 Get an overview of R for health data analysis. 4.7 Write basic scripts for data manipulation. **(CLOs I,II)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Write a script in R to clean and prepare a health data set for analysis. **(MLOs 4.6, 4.7)**	Create own repo on GitHub at upload your project for extra credit	
Module 5 Data Visualization with Python/R	**II**	- Learning Objective: 5.1 Learn data visualization libraries (ggplot2 for R, matplot, seaborn for python). 5.2 Create basic plots and charts. 5.3 Interpret visualizations to derive insights. **(CLOs II)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Create a series of plots and charts to visualize a provided health data set **(MLOs 5.1, 5.2, 5.3)**	Create own repo on GitHub at upload your project for extra credit	Module 5 on Canvas Optional: Textbook Chapter IV

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
Module 6 BI tools	**I,II,IV**	Introduction to Business Intelligence (BI) Tools – Learning Objective: 6.1 Overview of BI tools (Power BI, Tableau). 6.2 Understand the interface and functionalities of BI tools. 6.3 Import and visualize health data using BI tools. **(CLOs I,II,IV)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Create basic visualizations using Power BI and Tableau with provided health data sets. **(MLOs 6.1, 6.2, 6.3)**	Create own repo on GitHub at upload your project for extra credit	Module 6 on Canvas Optional: Textbook Chapter V
		Advanced BI Techniques – Learning Objective: 6.4 Learn advanced features of Power BI/Tableau (dashboards, calculated fields). 6.5 Create interactive and dynamic visualizations. 6.6 Analyze health trends using BI tools. **(CLOs I,II,IV)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Create basic visualizations using Power BI and Tableau with provided health data sets. **(MLOs 6.4, 6.5, 6.6)**	Create own repo on GitHub at upload your project for extra credit	

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
Module 7 Data Mining	**II**	– Learning Objective: 7.1 Introduction to data mining concepts. 7.2 Learn data mining techniques (e.g., clustering, association). 7.3 Apply data mining to discover patterns in health data. **(CLOs II)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Perform a data mining exercise on a health data set and report on the patterns discovered. **(MLOs 7.1, 7.2, 7.3)**	Create own repo on GitHub at upload your project for extra credit	Module 7 on Canvas Optional: Textbook Chapter VI
Module 8 Machine Learning	**V**	Machine Learning Fundamentals – Learning Objective: 8.1 Introduction to machine learning concepts. 8.2 Understand supervised vs. unsupervised learning. 8.3 Learn about common algorithms used in health data analysis. **(CLOs V)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Write a report summarizing the differences between supervised and unsupervised learning with examples from health data. **(MLOs 8.1, 8.2, 8.3)**	Create own repo on GitHub at upload your project for extra credit	Module 8 on Canvas Optional: Textbook Chapter VII

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Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
		Implementing Machine Learning Models – Learning Objective: 8.4 Learn to implement machine learning models in R/Python. 8.5 Train and test models using health data. 8.6 Evaluate model performance. **(CLOs V)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Implement a simple machine learning model on a health data set and evaluate its performance. **(MLOs 8.4, 8.5, 8.6)**	Create own repo on GitHub at upload your project for extra credit	
		Advanced Machine Learning Techniques – Learning Objective: 8.7 Explore advanced machine learning algorithms (e.g., decision trees, SVM). 8.8 Understand hyperparameter tuning. 8.9 Apply advanced models to health data. **(CLOs V)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Apply an advanced machine learning algorithm to a health data set and optimize its parameters. **(MLOs 8.7, 8.8, 8.9)**	Create own repo on GitHub at upload your project for extra credit	
Module 9 AI	**V**	Introduction to Artificial Intelligence (AI) and AI Applications in Health – Learning Objective:	**Quiz:** Code debugging and code	Create own repo on GitHub at upload your project for	Module 9 on Canvas

Module # and Title	Course Learning Outcomes (CLOs)	Module Learning Outcomes (MLOs)	Assessments and Rubrics	Activities: Learner Interaction & Engagement	Instructional Materials
		9.1 Understand the basics of AI and its applications in health. 9.2 Learn about AI techniques 9.3 Explore case studies of AI in health. **(CLOs V)**	completion **Assignemnt:** Problem solving with coding **Project:** Analyze a case study where AI has been applied to improve health outcomes and present findings. **(MLOs 9.1, 9.2, 9.3)**	extra credit	Optional: Textbook Chapter VII**I**
Module 10 Predictive Modeling	**III**	Predictive Modeling for Health Outcomes – Learning Objective: 10.1 Understand predictive modeling concepts. 10.2 Learn to build predictive models for health outcomes. 10.3 Evaluate the accuracy and reliability of predictive models. 10.4 Implement basic AI models 10.5 Use AI to predict health outcomes. 10.6 Understand ethical considerations in AI. **(CLOs III)**	**Quiz:** Code debugging and code completion **Assignemnt:** Problem solving with coding **Project:** Analyze a case Build and evaluate a predictive model for a specific health outcome using provided data. **(MLOs 10.1, 10.2, 10.3, 10.4, 10.5, 10.6)**	Create own repo on GitHub at upload your project for extra credit	Module 10 on Canvas Optional: Textbook Chapter VIII