



Course Syllabus

Course Code	Course Title	ECTS Credits
COMP-553DL	Data Science in Bioinformatics and Medicine	10
Prerequisites	Department	Semester
COMP-544DL	Computer Science	
Type of Course	Field	Language of Instruction
Elective	Data Science	English
Level of Course	Lecturer(s)	Year of Study
2 nd Cycle	Dr. Kalia Orphanou	
Mode of Delivery	Work Placement	Corequisites
Distance Learning	N/A	None

Course Objectives:

- This course covers the basics of dealing with different types of medical data such as genes, images, signals, and the types of medical data and data analysis challenges that you will likely encounter in each. We'll start with gathering the data, move on to classifying, analyzing and finally visualizing it.

Learning Outcomes:

After completion of the course students are expected to be able to:

1. demonstrate an understanding of the different medical data types and the area of bioinformatics
2. analyze medical images and sequence data (genes)
3. deal with different medical data format issues that need to be addressed for successful data pre-processing and mining methods to be carried out
4. implement a classification method such as decision tree, neural network, Bayesian network and apply that method for a specific medical task and domain
5. be familiar with the visualization of different types of medical data and analysis of medical images
6. be familiar with the ethics and privacy issues when dealing with health data

Course Content:

1. Medical data description: Introduction to different health and bioinformatics data format.
2. Data pre-processing: Data cleaning, feature selection and extraction.
3. Medical expert systems: Decision support systems for different medical tasks such as diagnosis, prognosis and treatment selection. The basic steps will be described for applying any classification method for each task and how to assess the model performance. Examples will be given, of various applications of classification methods on different medical task and domains.
4. Evaluation of the performance of the medical expert systems: evaluation metrics
5. Genomic data analysis/mining
6. Longitudinal (big) data analysis
7. Natural language processing/text mining
8. ECG analysis and signal processing
9. Medical image analysis such as ultrasound and mass spectrometry imaging
10. Data visualisation such as EEG, ECG, sequence of gene data, and medical images
11. Evolutionary computation in bioinformatics: Introduction to genetic algorithms and their applications in bioinformatics and medicine
12. Societal, legal and ethical issues when dealing with health data

Learning Activities and Teaching Methods:

Lectures, Practical Exercises and Assignments.

Assessment Methods:

Homework, Programming Assignments, On-line Quizzes, Final Assessment*

* The Final Assessment can be either a Final Exam or Final Assignment(s) with Viva

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Biomedical informatics: computer applications in health care and biomedicine	Shortliffe, Edward H., and James J. Cimino	Springer Science & Business Media	2013	978-1-4471-4474-8

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Data Science and Predictive Analytics: Biomedical and Health Applications using R	Ivo D. Dinov	Springer	2018	3319723471
Health Informatics Data Analysis: Methods and Examples	Xu D., Wang M, Zhou F.	Springer	2017	3319449791
Bioinformatics Programming using Python	Mitchell L. Model	Springer	2009	0596154509
Big Data Analytics in Bioinformatics and Healthcare	B. Wang,R. Li, W. Perrizo	IGI Publishing Hershey, PA, USA	2015	1466666110
Medical Informatics: Knowledge Management and Data Mining in Biomedicine	H.Chen,FullerS., Friedman C., Hersh W.	Springer Science & Business Media	2006	0387257396