BME2121: ARTIFICIAL INTELLIGENCE IN BIOMEDICAL ENGINEERING

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Artificial Intelligence in Biomedical Engineering

Subject Code
BME - Biomedical Engineering
Course Number
2121

Academic Unit
Biomedical Engineering (BME)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
CS1102 Introduction to Computer Studies / CS1302 Introduction to Computer Programming or equivalent#

Precursors
BME2036 Engineering Computing

Equivalent Courses
Nil

Exclusive Courses
Nil

Additional Information
Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

The aim of this course is to provide biomedical engineering students with advanced training of programming skills and fundamentals of technologies using artificial intelligence (AI) in the biomedical domain. Students are introduced of various modern computer programming languages and platforms for developing AI applications in the biomedical domain. The applications could include screening and diagnosis with biomedical imaging (MRI, CT, etc.) or physiological signals (ECG, EEG, EMG, etc.) as well as supporting clinical decision system using patient data for formulating diagnosis or healthcare workflow.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe principles of artificial intelligence and machine learning in biomedical engineering.		x		
2	Apply dry lab skills needed for biomedical and healthcare engineering applications.			x	
3	Demonstrate the implementation of AI techniques using relevant computer tools and platforms for biomedical applications.			x	
4	Analyze performance of the developed AI applications using known data sets.			x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will develop an understanding of key principles and technical details of artificial intelligence and machine learning as well as the use of computer programming techniques for biomedical engineering and healthcare applications.	1, 2	1 hr/week

2	Laboratory Work	Students will participate in laboratories including training with computer programming and practical skills in AI. Students will participate in additional tasks as self-practice.	2, 3, 4	3 hrs/week for 12 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	2, 3	30	2-3 assignments will be given
2	In-class/lab assessment	1, 2, 3, 4	10	In-class assessment or short home assignment will be given during/after the lab
3	Mini project	3, 4	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Assignments

Criterion

Ability on programming skills.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task
2. In-class/lab assessment

Criterion
Ability to achieve the desired programming tasks during the lab sessions.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
3. Mini project

Criterion
Ability to develop a practical application.

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Assessment Task
4. Examination

Criterion
Ability to explain in detail the technical aspects of using computer programming and AI for biomedical engineering.

Excellent (A+, A, A-)

High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus

- Biomedical and healthcare analytics using artificial intelligence
- Screening and diagnosis with biomedical imaging (MRI, CT, etc.)
- Screening and diagnosis with physiological signals (ECG, EEG, EMG, etc.)
- Clinical decision support system (CDSS) (use of patient data for formulating diagnosis or healthcare workflow)
- Machine learning, deep learning, and neural networks in biomedical engineering
- C programming language, Python programming language

Reading List

Compulsory Readings

	Title
1	Neural Networks and Artificial Intelligence for Biomedical Engineering, 1st Edition, Donna L. Hudson, Maurice E. Cohen, Wiley-IEEE Press (1999). (Latest edition)
2	Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, aPress (2019).
3	Machine Learning for Healthcare Analytics Projects: Build Smart AI Applications using Neural Network Methodologies across the Healthcare Vertical Market, Eduonix Learning Solutions, Packt Publishing Limited (2018).

Additional Readings

	Title
1	Deep Learning with Python, Francois Chollet, Manning Publications (2017).
2	C Programming Language, 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall (1998). (Latest edition)