BMS5010: ARTIFICIAL INTELLIGENCE IN HEALTH SCIENCE RESEARCH AND MANAGEMENT

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Artificial Intelligence in Health Science Research and Management

Subject Code
BMS - Biomedical Sciences
Course Number
5010

Academic Unit
Biomedical Sciences (BMS)

College/School
College of Biomedicine (BD)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course seamlessly integrates health science and artificial intelligence (AI), offering a dynamic approach to propel both domains forward. Embracing project-based learning, the curriculum ensures students acquire both theoretical knowledge and hands-on experience in cutting-edge AI applications within health science research and management. Topics covered include (1) foundational AI concepts such as machine learning and deep learning, (2) computer vision models, (3) language models, (4) graph models, (5) AI for multi-omics data analysis, (6) drug discovery, and (7) disease diagnosis and prognosis. The emphasis is on cultivating an understanding of AI technologies, enabling biomedical students to apply AI tools effectively to address health science inquiries through curated datasets and practical exercises. This interdisciplinary course is designed to bridge the gap between health science and AI, empowering biomedical students with learned AI skills to contribute meaningfully to advancements in health science research and management.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	To understand the basic principles of AI algorithms, including the basic theory and the inspiration from health science and biomedical science.	30	x	x	
2	To understand how AI can be applied to real world questions in health science and the advantages and disadvantages.	30	x	x	x
3	To gain practical experience in solving real world questions in health science with AI-inspired algorithms, including model evaluation and interpretation.	40	x	x	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	Lectures	Theoretical concepts of the AI algorithms, and introduction to each health science problem and its AI applications.	1, 2	2 hours/week

2	Practical labs	Investigate curated datasets for each health science problem learn the practical ways to optimize the performance, learn how to evaluate and interpret the AI models compare the pros and cons of different AI algorithms . Practical guide for assignments and final group project.	1, 2, 3	1 hours/week

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Assignments	1, 2, 3	25	
2	Mid-term Examination	1, 2, 3	25	
3	Final group project presentation	1, 2, 3	10	
4	Final group project report	1, 2, 3	40	

Continuous Assessment (%)

100

Assessment Rubrics (AR)

Assessment Task

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Can run and demonstrate the analysis codes and results successfully in practical labs.

Excellent

(A+, A, A-) Outstanding performance on all CILOs. Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

Good

(B+, B, B-) Substantial performance on all CILOS. Evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with literature.

Fair

(C+, C, C-) Satisfactory performance on the majority of CILOS possibly with a few weaknesses. Being able to profit from the course experience; understanding of the subject; ability to develop solutions to simple problems in the material.

Marginal

(D) Barely satisfactory performance on a number of CILOS. Sufficient familiarity with the subject matter to enable the student to progress without repeating the course

Failure

(F) Unsatisfactory performance on a number of CILOS. Failure to meet specified assessment requirements, little evidence of familiarity with the subject matter; weakness in critical and analytic skills; limited or irrelevant use of literature.

Assessment Task

Mid-term Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Can analyse, state and apply the principles and subject matter learnt in the lectures.

Excellent

(A+, A, A-) Outstanding performance on all CILOs. Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

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Assessment Task

Final group project presentation (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

(1) Can clearly present project works in English with well- structured slides and good presentation skills.
(2) Can answer to questions comfortably and actively raise questions in others' presentations.

Excellent

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Assessment Task

Final group project report (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

(1) Can select and state a health science problem, its datasets and current AI applications.
(2) Can provide the runnable codes for the selected AI methods on selected datasets.
(3) Can benchmark the selected AI methods, and present the benchmark results with interpretable tables/figures.
(4) Can make critical thinking on the pros and cons of the AI methods in discussion.
(5) Can present the report with a clear, concise, and academic way.

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Assessment Task

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

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Can run and demonstrate the analysis codes and results successfully in practical labs.

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Part III Other Information

Keyword Syllabus

Principles of Artificial Intelligence,
Machine Learning,
Deep Learning,
Model Training, Testing, and Validation,
Computer Vision,
Convolutional neural networks,
Graph neural networks,
Language Models,
Multi-Omics Data,
Drug Discovery,
Disease Diagnosis and Prognosis

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems"; 2nd edition; by Aurélien Géron; O'Reilly Media 2019
2	"Deep Learning for the Life Sciences"; by Bharath Ramsundar, Peter Eastman, Pat Walters, Vijay Pande; O'Reilly Media 2019
3	"Data Mining: Practical Machine Learning Tools and Techniques"; 4th Edition; by Ian H. Witten, Eibe Frank, Mark A. Hall and Christopher Pal; Morgan Kaufmann 2016
4	"Pattern Recognition and Machine Learning"; by Christopher M. Bishop; Springer 2006