Subject Description Form

Subject Code	BME44144
Subject Title	AIDA for Biosignal Processing and Medical Imaging
Credit Value	3
Level	4
Pre-requisite	BME31116 Biosignal Processing
Objectives	To equip students with basic knowledge and opportunities as well as risk of AIDA techniques for biosignal processing and medical imaging, and supply with examples in various application scenes. Thus, the students are capable of using AIDA as an essential tool in biosignal and medical imaging processing and analysis.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the potentials and fundamentals of artificial intelligence and big data techniques in biosignal processing and medical imaging b. Design AIDA systems, components and processes to meet given specifications and constraints in biosignal processing and medical imaging c. Identify, formulate and solve problems relevant to AIDA in biosignal processing and medical imaging d. Use modern IT tools appropriate to AIDA practice in biosignal processing and medical imaging e. Understand the quality, regulatory, and ethical issues related to the use of AIDA in biosignal processing and medical imaging
Contribution to Programme Outcomes (Refer to Part I Section 10)	▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach and Practice); ▪ Program Learning Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data (Teach and Practice); ▪ Program Learning Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice (Teach and Practice); ▪ Program Learning Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations (Teach and Practice).

<table>
<tr><td>Subject Synopsis / Indicative Syllabus</td><td>

Landscape changes and opportunities: introduction of artificial intelligence and big data techniques for biomedical signal and imaging processing
Characterization of biomedical signals: feature engineering and extraction
Supervised and unsupervised learning
Neural networks: understanding and applications
Basic principles of deep learning and machine learning in imaging
Deep learning and machine learning applications with ECG and EEG signals
Data / image preparation for deep learning and machine learning; quality and curation of medical images and data; the value of structured reporting and enterprise imaging platform
Imaging biomarkers, imaging biobanks, and radiomics
Applications beyond image interpretation, such as for cardiovascular disease, breast cancer screening, and evaluation of neurological diseases, etc.
Potentials, advantages, challenges, and risks of AIDA in biomedical signal and image processing

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<tr><td>Teaching / Learning Methodology</td><td>Students will learn the fundamentals and principles in lectures; Sufficient laboratory and tutorial hours will be provided; Practice projects/assignments will be adopted to assess the students' learning outcomes.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="5">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td></tr>
<tr><td>1.In-class quiz</td><td>10%</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.Assignments (X2)</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>3.Labs (X2)</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>4.Final project (X1)</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="5"></td></tr>
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Note: To pass this subject, students must obtain grade D or above.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The in-class quiz (multiple times in lectures and tutorials) is used to encourage the engagement of the students, and to assess the degree of the understanding the fundamentals of AIDA.
Assignments and the final project are used to assess the degree that the students understand the knowledge and ability to apply the knowledge to solve problems and practice.
The lab sessions are focused on testing the student on how much they gain practical experience and apply knowledge in practice.

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Student Study Effort Expected	Class contact:	
	▪ Lecture	10 Hrs.
	▪ Tutorials	20 Hrs.
	▪ Labs	9 Hrs.
	Other student study effort:	
	▪ Assignments, lab report, and final project	39 Hrs.
	▪ Self-study	39 Hrs.
	Total student study effort	117 Hrs.
Reading List and References	▪ Walid Zgallai (editor), Biomedical Signal Processing and Artificial Intelligence in Healthcare, Academic Press (2020), https://doi.org/10.1016/C2018-0-04775-1 ▪ Erik R. Ranschaert, Sergey Morozov, and Paul R. Algra, Artificial Intelligence in Medical Imaging： Opportunities, Applications and Risks, Springer (2019), https://doi.org/10.1007/978-3-319-94878-2	
Date of Last Revision	August 2022	