26. Artificial Intelligence in Geophysics

Module Name	:	Artificial Intelligence in Geophysics
Module Level	:	Bachelor
Code, if applicable	:	23H06130402
Subtitle, if applicable	:	-
Courses, if applicable	:	Artificial Intelligence in Geophysics
Semester(s) in which the module is taught	:	V (Fifth Semester)
Module coordinator(s)	:	Dr. Muhammad Alimuddin, Eng.
Lecturer(s)	:	Dr. Muhammad Alimuddin, Eng. and Dr. Muhammad Taufiq Rafie
Language	:	Bahasa (Indonesian language)
Relation to curriculum	:	Compulsory course in the third year for Bachelor Degree in Geophysics
Type of teaching, contact hours	:	This course is delivered through Lectures (i.e., Project/Case-based learning), complemented by structured assignments (paper review, project/case evaluation) and independent study. Contact hours consist of 100 minutes lectures per week, plus 120 minutes per week for each of the following: structured assignments and independent study
Workload	:	Total workload is 90 hours per semester, consisting of 28 hours for lectures, and 31 hours each for structured assignments and independent study
Credit points	:	2 SKS (3.2 ECTS)
Requirements according to the examination regulations	:	Students are eligible to attend the examination if their absences are less than 20% of the lectures
Recommended prerequisites	:	Mathematical Geophysics I, Geophysical Computing Method I
Module objectives/intended learning outcomes	:	After completion of this module, students will be able to: CLO 1. Able to apply machine learning concepts to supervised and unsupervised problems on geophysical data; CLO 2. Able to apply TensorFlow to geophysical data problems. The following is the mapping of the ILO and the CLO of this course:

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<tr><td></td><td>ILO 5</td><td>ILO 14</td></tr>
<tr><td>CLO 1</td><td>✓</td><td></td></tr>
<tr><td>CLO 2</td><td></td><td>✓</td></tr>
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<tr><td>Content</td><td>:</td><td>1. Supervised Machine Learning
2. Unsupervised Machine Learning
3. Single layer and multi-layer Neural Network (NN)
4. Deep Learning
5. Convolutional Neural Network (CNN)
6. Tensorflow dan the application</td></tr>
<tr><td>Study and examination requirements</td><td></td><td>Participants are marked based on their performance in theory: Participatory activity (16%), Project/ Case Study (78%), and Quiz (6%).

Students are marked based on their percentage of points obtained and based on the following grade scale:
<table>
<tr><th>Percentage of Achievement</th><th>Grade</th><th>Conversion Value</th></tr>
<tr><td>85 – 100</td><td>A</td><td>4.00</td></tr>
<tr><td>80 - <85</td><td>A-</td><td>3.75</td></tr>
<tr><td>75 - < 80</td><td>B+</td><td>3.5</td></tr>
<tr><td>70 - < 75</td><td>B</td><td>3.0</td></tr>
<tr><td>65 - < 70</td><td>B-</td><td>2.75</td></tr>
<tr><td>60 - < 65</td><td>C+</td><td>2.5</td></tr>
<tr><td>50 - < 60</td><td>C</td><td>2.00</td></tr>
<tr><td>40 - < 50</td><td>D</td><td>1.00</td></tr>
<tr><td>< 40</td><td>E</td><td>0.00</td></tr>
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<tr><td>Exams and assessment formats</td><td></td><td>Assessment in this course consists of a participatory activities, project or case study and quizzes. Participatory activities include active involvement in class discussions, problem-solving sessions, or peer feedback exercises, and are evaluated based on engagement, relevance of contribution, and collaboration with peers. The project or case study is conducted individually or in</td></tr>
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		groups and requires students to apply theoretical concepts to analyze and solve a problem, culminating in a written report that is evaluated and may be revised after feedback. Quizzes are administered in a closed-book written format, typically consisting of short-answer and multiple-choice questions, to monitor students' ongoing understanding and provide early feedback on learning progress.
Reading list		Main References: 1. Pattel, A.A. 2019. Hands-on unsupervised learning using Python: how to build applied machine learning solutions from unlabeled data. O'Reilly Media. Additional References: 1. Moroney, L. 2020. AI and Machine Learning for coders. O'Reilly Media 2. Kim, P. 2017. Matlab deep learning. With machine learning, neural networks and artificial intelligence, 130(21). 3. Brunton, S.L and Kutz, J.N. 2022. Data-driven science and engineering: Machine learning, dynamical systems, and control. Cambridge University Press
Last revision date		July 1st, 2025