# SEMESTER STUDY PLAN (SSP)

# INTRODUCTION TO ARTIFICIAL INTELLIGENCE

# ELECTIVE COURSE


**DEPARTMENT OF MATHEMATICS DAN DATA SCIENCE**

**FACULTY OF MATHEMATICS AND NATURAL SCIENCES**

**UNIVERSITAS ANDALAS**

**2023/2024**

## 1. Semester Study Plan (SSP)

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| | **SEMESTER STUDY PLAN (SSP)**<br>**BACHELOR PROGRAM OF MATHEMATICS**<br>**FACULTY OF MATHEMATICS AND NATURAL SCIENCES**<br>**UNIVERSITAS ANDALAS** |

| **Course Name** | **Course Code** | **URL iLearn** | **Credits** | **Semester** | **Compilation Date** |
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| INTRODUCTION TO ARTIFICIAL INTELLIGENCE | MAT61256 | https://sci.ilearn.unand.ac.id | 3 | 7 | May 8th, 2024 |

| **Person in Charge** | **Study Plan Creator** | **Head of Research Group** | **Head of Study Program** |
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| | Dr. Dodi Devianto<br>Mawanda Almuhayar, M.Sc | Yudiantri Asdi, M.Sc | Dr. Noverina Alfiany |

| **Learning Outcomes** | **Intended Learning Outcomes (ILO)** | |
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| | ILO-5 | An ability to formally and correctly prove a simple mathematical statement using facts and methods that have been studied. |
| | ILO-6 | Have ability data literacy and technology and can apply them in solving simple mathematical problems or other relevant fields |
| | ILO-7 | An ability to communicate effectively especially in the area of mathematics in with diverse communities. |
| | **Course Learning Outcomes (CLO)** | |
| | 1 | An ability to explain artificial intelligence (AI) and the history of its development in everyday life. (ILO-5) |
| | 2 | An ability to explain the types of AI that can be used in everyday life and terms in AI that are commonly used. (ILO-5) |

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| | 3 | An ability to create perceptron models and multi-layer perceptrons or neural networks using data based on events in everyday life. (ILO-5, ILO-6) |
| | 4 | An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6) |
| | 5 | An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) |
| | 6 | An ability to apply neural network models to various cases of modeling and data analysis using data based on events in everyday life and explain the results obtained and their benefits for decision-making. (ILO-5, ILO-6, ILO-7) |
| **Course Brief Description** | This course applies the *Case-Based* Method (CBM), which is a learning method that uses cases as a medium for learning development. Course participants explore, assess, synthesize, and interpret information based on cases to produce an analysis and develop a solution plan.<br><br>In this course, students will learn about artificial intelligence (AI) methods used for data modeling and analysis which include the introduction and history of AI development, types and terms in AI, perceptron models and multi-layer perceptrons or neural networks, neural network model training, neural network model optimization, and neural network model applications in various selected cases such as regression, classification, and time series and accompanied by an introduction to the software and programming languages used to build these models. | |
| **Course Material** | 1. Introduction and History of the Development of Artificial Intelligence (AI).<br>2. Types and terms in AI.<br>3. Perceptron Model and Multi-Layer Perceptron or Neural Network.<br>4. Neural Network Model Training: Forward Pass and Backpropagation.<br>5. Neural Network Optimization: Gradient Descent and Stochastic Gradient Descent. | |

<table>
<tr><td></td><td colspan="2">6. Application of Neural Network models in Regression, Classification, and Time Series cases.</td></tr>
<tr><td rowspan="2">References</td><td colspan="2">Main:<br>1. S. Russel, P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Harlow, Essex: Pearson Education, 2021.<br>2. Suyanto, Artificial Intelligence: Searching, Reasoning, Planning, and Learning, 3rd ed. Bandung: Informatika, 2021.</td></tr>
<tr><td colspan="2">Additional:<br>3. C. M. Bishop, Pattern Recognition and Machine Learning. New York: Springer, 2006.<br>4. C. M. Bishop, H. Bishop, Deep Learning: Foundations and Concepts. Cham, Switzerland: Springer, 2024.</td></tr>
<tr><td rowspan="2">Learning Media</td><td>Software:</td><td>Hardware:</td></tr>
<tr><td>◆ LMS UNAND (https://sci.ilearn.unand.ac.id/)<br>◆ Zoom Meeting / Microsoft Teams<br>◆ WhatsApp<br>◆ SPSS<br>◆ R<br>◆ Python</td><td>◆ Computer / Laptop<br>◆ Smartphone<br>◆ LCD Projector</td></tr>
<tr><td>Team Teaching</td><td colspan="2">◆ Mawanda Almuhayar, M.Sc<br>◆ Dr. Dodi Devianto</td></tr>
<tr><td>Required Courses</td><td colspan="2">◆ MAT61151 Data Analysis</td></tr>
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| | ◆ MAT62252 Regression Analysis |
| **Academic Rules** | https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf |

### 1.1 Weekly Study Plan

| Week / Meeting (1) | CLO (2) | Assessment Indicators (3) | Forms of Assessment (4) | Learning Activities [Time Estimation] | | | | Learning Materials [Reference] (10) | Assessment Weights (11) |
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| | | | | Synchronous | | Asynchronous | | Media (9) | |
| | | | | Face-to-Face Offline (5) | Face-to-Face Online (6) | Self-Paced (7) | Collaborative (8) | | |
| W1 / M1 | CLO 1<br>An ability to explain artificial intelligence (AI) and the history of its development in everyday life. (ILO-5) | ◆ Discipline in carrying out course contract<br>◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | ◆ Self-Paced Learning<br>[1 x 3 x 120 minutes] | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Assessment Rules, SSP, Syllabi, Course Contract<br>❖ Course overview<br>❖ Introduction and History of the Development of Artificial Intelligence<br>[1], [2] | |

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| W2 / M2 | CLO 2<br>An ability to explain the types of AI that can be used in everyday life and terms in AI that are commonly used. (ILO-5) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND )<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Types and terms in AI<br>[1], [2] | |
| W3 / M3 | CLO 3<br>An ability to create perceptron models and multi-layer perceptrons or neural networks using data based on events in everyday life. (ILO-5, ILO-6) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | ◆ Self-Paced Learning<br>[1 x 3 x 120 minutes] | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND )<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Perceptron Model and Multi-Layer Perceptron or Neural Network:<br>◆ Perceptron Model<br>[1], [2] | |
| W4 / M4 | CLO 3<br>An ability to create perceptron models and multi-layer perceptrons or neural | ◆ Liveliness and participation in discussions<br>◆ Accuracy in explaining | ◆ Liveliness and Participation<br>◆ Assignment 1 | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material | | ◆ Structured Assignment<br>[1 x 3 x 120 minutes] | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND ) | ◆ Multi-Layer Perceptron Model<br>[1], [2] | 10% |

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| | networks using data based on events in everyday life. (ILO-5, ILO-6) | related material | | [1 x 3 x 50 minutes] | | | | ◆ SPSS<br>◆ R<br>◆ Python | | |
| W5 / M5 | CLO 4<br>An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Neural Network Model Training:<br>◆ Forward Pass<br>◆ Backpropagation<br>[1], [2] | |
| W6 / M6 | CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Neural Network Optimization:<br>◆ Gradient Descent<br>◆ Stochastic Gradient Descent<br>[1], [2] | |
| W7 / M7 | CLO 4<br>An ability to train neural network | ◆ Liveliness and participation | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material | | | ◆ Collaborative Learning<br>[1 x 3 x 120 minutes] | ◆ Learning Slides / Videos | ❖ Introduction to software and programming | |

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| | models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6)<br><br>CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | in discussions | | ◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ LMS (iLearn UNAND )<br>◆ SPSS<br>◆ R<br>◆ Python | languages for building *Neural Network models*<br><br>[1], [2] | |
| **W8 – W9 / -** | **Midterm Exam** | | | | | | | | | **25%** |
| W10 / M8 | CLO 6<br>An ability to apply neural network models to various cases of modeling and data analysis using data based on events in | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND )<br>◆ SPSS<br>◆ R | ❖ Application of Neural Network models:<br>◆ Case Study of Regression Models on | |

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| | everyday life and explain the results obtained and their benefits for decision-making. (ILO-5, ILO-6, ILO-7) | | | | | | | ◆ Python | Neural Network<br>[1], [2] | |
| W11 / M9 | CLO 4<br>An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6)<br><br>CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | ◆ Collaborative Learning<br>[1 x 3 x 120 minutes] | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ◆ Software and programming languages for building Regression Models on Neural Networks<br>[1], [2] | |

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| W12 / M10 | CLO 6<br>An ability to apply neural network models to various cases of modeling and data analysis using data based on events in everyday life and explain the results obtained and their benefits for decision-making. (ILO-5, ILO-6, ILO-7) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Application of Neural Network models:<br>◆ Case Study of Classification Models on Neural Network<br>[1], [2] | |
| W13 / M11 | CLO 4<br>An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6)<br><br>CLO 5 | ◆ Liveliness and participation in discussions<br>◆ Accuracy in explaining related material | ◆ Liveliness and Participation<br>◆ Assignment 1 | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | ◆ Structured Assignment<br>[1 x 3 x 120 minutes] | ◆ Collaborative Learning<br>[1 x 3 x 120 minutes] | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ◆ Software and programming languages for building Classification Models on Neural Networks<br>[1], [2] | 10% |

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| | An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | | | | | | | | | |
| W14 / M12 | CLO 6<br>An ability to apply neural network models to various cases of modeling and data analysis using data based on events in everyday life and explain the results obtained and their benefits for decision-making. (ILO-5, ILO-6, ILO-7) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ❖ Application of Neural Network models:<br>◆ Case Study of Time Series Models on Neural Network<br>[1], [2] | |

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| W15 / M13 | CLO 4<br>An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6)<br><br>CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material<br>[1 x 3 x 50 minutes] | | | ◆ Collaborative Learning [1 x 3 x 120 minutes] | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND)<br>◆ SPSS<br>◆ R<br>◆ Python | ◆ Software and programming languages for building Time Series Models on Neural Networks<br>[1], [2] | |
| W16 / M14 | CLO 4<br>An ability to train neural network models with various model architectures using data based on | ◆ Liveliness and participation in discussions | ◆ Liveliness and Participation | ◆ Explanation of Lecture Material<br>◆ Discussion and Q&A of Lecture Material | | | ◆ Collaborative Learning [1 x 3 x 120 minutes] | ◆ Learning Slides / Videos<br>◆ LMS (iLearn UNAND) | ❖ Application of *the Neural Network* model to other selected cases<br>[1], [2] | |

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| | events in everyday life. (ILO-5, ILO-6)<br><br>CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6)<br><br>CLO 6<br>An ability to apply neural network models to various cases of modeling and data analysis using data based on events in everyday life and explain the results obtained and their benefits for decision- | | | [1 x 3 x 50 minutes] | | | | ◆ SPSS<br>◆ R<br>◆ Python | | |

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| | making. (ILO-5, ILO-6, ILO-7) | | | | | | | | | |
| **W17 – W18 / -** | **Final Exam / Final Project** | | | | | | | | | **55%** |

## 1.2 Indicators, Criteria, and Assessment Weights

a. Assessment Weights of Each Form of Assessment:
   1) Assignment : 20%
   2) Midterm Exam : 25%
   3) Final Exam / Final Project : 55%

b. Assessment Weight of Each Course Learning Outcomes (CLO):
   1) CLO 1 : 10%
   2) CLO 2 : 10%
   3) CLO 3 : 20%
   4) CLO 4 : 15%
   5) CLO 5 : 15%
   6) CLO 6 : 30%

**Note:**
The weight of the assessment, the form of assessment, and the learning outcomes must be in sync

## 2. Assessment Plan Table

| Forms of Assessment | Assignment | | Midterm Exam | Final Exam / Final Project | Total Weight |
|---|---|---|---|---|---|
| CLO | 1 | 2 | | | |
| CLO 1<br>An ability to explain artificial intelligence (AI) and the history of its development in everyday life. (ILO-5) | | | 5% | 5% | 10% |
| CLO 2<br>An ability to explain the types of AI that can be used in everyday life and terms in AI that are commonly used. (ILO-5) | | | 5% | 5% | 10% |
| CLO 3<br>An ability to create perceptron models and multi-layer perceptrons or neural networks using data based on events in everyday life. (ILO-5, ILO-6) | 10% | | 5% | 5% | 20% |
| CLO 4<br>An ability to train neural network models with various model architectures using data based on events in everyday life. (ILO-5, ILO-6) | | 5% | 5% | 5% | 15% |
| CLO 5<br>An ability to optimize neural network models to get the best model parameters using data based on events in everyday life. (ILO-5, ILO-6) | | 5% | 5% | 5% | 15% |
| CLO 6 | | | | 30% | 30% |

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| An ability to apply neural network models to various cases of modeling and data analysis using data based on events in everyday life and explain the results obtained and their benefits for decision-making. (ILO-5, ILO-6, ILO-7) | | | | | |
| **Total Weight** | 10% | 10% | 25% | 55% | **100%** |