SEMESTER LEARNING ACTIVITY PLANS
(SLAP)
SEMESTER EVEN 2022/2023

Data Science for Geosciences

MFF5070 / 2 Credits

Lecturer Coordinator:

UNIVERSITAS GADJAH MADA
FACULTY OF MATHEMATICS AND NATURAL SCIENCE
2022

Universitas Gadjah Mada
Faculty of Mathematics and Natural Science
Physics Department / Study Program Master of Physics
Semester Even 2022/2023

SEMESTER LEARNING ACTIVITY PLANS (SLAP)

Code	Course Name	Credits (credits)	Semester	Status	Prerequisite
MFF5070	*Data Science for Geosciences*	*2*	*Even*	*Elective*	*None*

Short Description

Data Science for Geosciences course is Elective course 2 credits (Theory) in the 2022 Curriculum Master of Physics Study Program, Faculty of Mathematics and Natural Science UGM.

The syllabus of this course is as follows:
Review and prospects of data science in geoscience, standard methodology of data science, the concept of visual and statistical data review, data cleaning and transformation, feature/feature engineering (selection techniques and/or reduction of features qualitatively and quantitatively), classification models (logistic regression, decision tree, naïve Bayer classifier, k-nearest neighbor, boosting algorithm, support vector classifier), regression model (simple linear regression and multi variables, polynomial and non-linear regression, support vector regression, random forest regression), model clustering (distance method, K-means, hierarchical, DBSCAN), Artificial Neural Network (ANN) model and deep learning, model evaluation.

The courses are held in class for 14 weeks, each week's session last for 2 x 50 minutes. Four weeks of course period is used for Midterm Exam and Final Exam, each held for two weeks as scheduled.

Student evaluation for course assessments is performed summative and formative. The summative evaluation is implemented as written exams, both Midterm and Final Exam, which take a maximum of 120 minutes. The formative evaluation is implemented as individual assignments for each student in the form of completing an assignment individually. Monitoring is carried out by observing student activities during the course, such as attendance, Q&A and discussion about the material presented, and student performance in completing individual assignments.

Program Learning Outcomes (PLO) Imposed on the Course

PLO 3	Mastering further knowledge of classical and modern physics theory, and its relationship with other disciplines, and has mastered an advanced field of physics specialization that allows him to keep up with the latest international research developments.
PLO 4	Mastering various mathematical disciplines related to an advanced field of physics, and able to develop physical models using various mathematical and computational tools with an inter or multidisciplinary approach to solving problems related to an advanced field of physics.
PLO 5	Able to plan, manage and carry out experiments and conclude the results, or be able to create and use modeling and simulations based on the basic principles of physics to study and solve a problem in a scientific field of Physics or applied Physics that produces models, methods, or theories tested and innovative.
PLO 6	Able to apply knowledge to analyze, synthesize, formulate problems and solve problems comprehensively in one of advanced field of physics, through

		experimental or theoretical research, then be able to classify and draw conclusions about their findings for the development of science and technology.
	PLO 7	Able to communicate and discuss orally and in writing the results of studies, and mastery of various problems in the field of physics and other related fields in Indonesian and English, as well as being able to document and save the results of the study and mastery, and publish them in reputable scientific forums or scientific journals.

Course Outcomes (CO)	**Upon completion of this course, students should be able to:**	
	CO1	Understand and practice the visual and statistical data review process on geoscientific data.
	CO2	Understand and practice the feature engineering process on geoscientific data.
	CO3	Understand and practice machine learning algorithms for geoscientific data.
	CO4	
	CO5	
	CO6	
	CO7	
	CO8	

The Correlation of CO to Learning Materials and Methods, and Time Allocation		**Learning Materials**	**Learning Methods**	**Time Allocation**
	CO1			2 x 50 minutes
	CO1			2 x 50 minutes
	CO1			2 x 50 minutes
	CO2			2 x 50 minutes
	CO2			2 x 50 minutes
	CO2			2 x 50 minutes
	CO2			2 x 50 minutes
	CO3			2 x 50 minutes
	CO3			2 x 50 minutes
	CO3			2 x 50 minutes
	CO4			2 x 50 minutes
	CO4			2 x 50 minutes
	CO4			2 x 50 minutes

	CO4			2 x 50 minutes
	Final Exam/ Project Task Results/ Case Analysis Results			
Learning Methods				
Student Learning Experience	Learn to analyze and review: , , , , , , , , , , , , , , .			
Access to Learning Media/ LMS and Offline and Online Percentage				

Assessment Methods and Synchronization with CO

Assessment Methods	**Assessment Percentage**	**Criteria/Indicators**	**CO1**	**CO2**	**CO3**	**CO4**
Participatory Activity*						
Project Results/ Case Study Results/ PBL Results*						
Cognitive						
Assignment	30%		7,5%	7,5%	7,5%	7,5%
Quiz						
Midterm Exam	35%		17,5%	17,5%		
Final Exam	35%				17,5%	17,5%

*) can also be obtained from the Midterm or Final Exam as the result of participatory activities or project/ case study results. According to IKU 7, the percentage of project results/ case study/ PBL results is at least 50%.

References	**Main references:** 1. Aggarwal, C. C. (2021). An Introduction to Artificial Intelligence. In Artificial Intelligence (pp. 1-34). Springer, Cham. 2. Bishop, C.M. (2006). Pattern recognition. Machine learning, 128(9). 3. Duda, R.O., & Hart, P. E. (2006). Pattern classification. John Wiley & Sons. 4. Aggarwal, C. C. (2021). An Introduction to Artificial Intelligence. In Artificial Intelligence (pp. 1-34). Springer, Cham. 5. Zheng, A., & Casari, A. (2018). Feature engineering for machine learning: principles and techniques for data scientist."O'Reilly Media, Inc.".
Lecturers (*Team Teaching*)	1. 2. 3. 4.

Authorization	**Date of Drafting**	**Lecturer Coordinator**	**Head of Curriculum Committee**	**Head of Study Program**

			Dr.Ing. Ari Setiawan	Mirza Satriawan, M.Si., Ph.D