Transitional work on machine learning in smart environment – individually selected issue solved under the supervision of a tutor

Course description sheet

Basic information

Field of study Remote Sensing and Geo Informatics **Major** All **Organisational unit** Faculty of Geo-Data Science, Geodesy, and Environmental Engineering **Study level** Second-cycle studies **Form of study** Full-time studies **Profile** General academic	**Didactic cycle** 2025/2026 **Course code** DRSGIS.II2.15498.25 **Lecture languages** English **Mandatoriness** Obligatory **Block** Core Modules **Course related to scientific research** Yes

Course coordinator	Ewa Głowienka
Lecturer	Beata Hejmanowska, Ewa Głowienka, Natalia Borowiec, Wojciech Drzewiecki, Tomasz Pirowski, Antoni Rzonca, Mariusz Twardowski

Period	**Method of verification of the learning outcomes**	**Number of ECTS credits**
Semester 2	Exam **Activities and hours** Control and transitional thesis: 150	10

Goals

G1	To carry out a transition work, the purpose of which is to perform scientific research work on machine learning in smart environment, prepare a report and defend it in the form of an exam.

Course's learning outcomes

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
Knowledge – Student knows and understands:			
W1	advanced knowledge of time series analysis	RSGI2A_W01	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research
W2	advanced knowledge in machine learning	RSGI2A_W03, RSGI2A_W04	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research
W3	advanced knowledge about application of geo-informatics in smart environment	RSGI2A_W04, RSGI2A_W05, RSGI2A_W06, RSGI2A_W07	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research
Skills – Student can:			
U1	apply time series analysis and machine learning in practice	RSGI2A_U02, RSGI2A_U03, RSGI2A_U04	Participation in a discussion, Report, Case study, Preparation and conduct of scientific research
U2	perform advanced spatial analysis for smart environment	RSGI2A_U03, RSGI2A_U04	Participation in a discussion, Report, Case study, Preparation and conduct of scientific research
Social competences – Student is ready to:			
K1	intentionally select fit-to-use data	RSGI2A_K02	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research
K2	independently and creatively solve problems in the scope of smart enivironment	RSGI2A_K02	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research

Program content ensuring the achievement of the learning outcomes prescribed to the module

The student will acquire advanced knowledge of the possibilities of machine learning in smart environment. The student chooses an individual project from the available selection of topics or proposes his/her own topic. This module is fully elective in terms of both the subject matter and the instructor.

Student workload

Activity form	Average amount of hours* needed to complete each activity form
Control and transitional thesis	150
Examination or final test/colloquium	2
Realization of independently performed tasks	50
Preparation of project, presentation, essay, report	30
Preparation for classes	30

Student workload	**Hours** 262
Workload involving teacher	**Hours** 150

* hour means 45 minutes

Program content

No.	Program content	Course's learning outcomes	Activities
1.	Within the block of classes, the student practically applies knowledge and skills from four modules completed in the first part of the semester: Time series analysis, Machine Learning, Application of Mathematics, Data Science for Smart Environment, Geo-information Tools. The student chooses an individual project from the available selection of topics or proposes his/her own topic. Within the lecture part, the student is introduced to the knowledge of the performed topics. He or she learns the characteristics of scientific research: conducting a literature review, critical analysis, defining the research problem, making a hypothesis, planning an experiment, conducting and documenting the research developing a report. The workshop part consists of performing comprehensive work to solve the selected problem. The work includes the design part, data collection, data processing, preparation of a report. During the workshop, the student consults the results of his research with the supervisor. The class ends with the defense of the interim work at the exam.	W1, W2, W3, U1, U2, K1, K2	Control and transitional thesis

Extended information/Additional elements

Teaching methods and techniques :

Workshop, Mentoring, Design thinking, Case study, E-learning, Discussion

Activities	Methods of verification	Credit conditions
Control and transitional thesis	Participation in a discussion, Examination, Report, Case study, Preparation and conduct of scientific research	Verification of the knowledge during the exam as part of the transitional work passing. Worshops are mandatory. Credit is based on student's activity.

Conditions and the manner of completing each form of classes, including the rules of making retakes, as well as the conditions for admission to the exam

Credit of the worshop - on the basis of attendance at classes.
A student may proceed to a resit twice.

Method of determining the final grade

Final grade = average of exam and worshop assignments.

Manner and mode of making up for the backlog caused by a student justified absence from classes

Compensating for the backlog caused by absence: depending on the classes subject – self-realisation of excercises with the help of individual consultations with the instructor.

Prerequisites and additional requirements

Knowledge of subjects: Time series analysis, Machine Learning, Application of Mathematics
Data Science for Smart Environment, Geo-information Tools

Rules of participation in given classes, indicating whether student presence at the lecture is obligatory

Classes in the semester are conducted in blocks. Transitional work is preceded by blocks: Time Series Analysis, Machine learning, Data Science for Smart Environment and Geo-information Tools.
Workshops include the training of practical application of the knowledge and is compulsory.

Literature

Obligatory

1. DissertationAdviser.com http://dissertationadviser.com/dissertation-writing-tutorial-mastering-the-apa-format.aspx (access: 25.11.2022)
2. First Call Magazine.com http://www.firstcallmagazine.com/what-is-a-dissertation (access: 25.11.2022)
3. Przemysław Biecek, Zbiór esejów o sztuce prezentowania danych, http://biecek.pl/Eseje/

Scientific research and publications

Publications

1. Borowiec N., Marmol U., 2022. Using LiDAR system as a data source for agricultural land boundaries Remote Sensing, vol. 14 iss. 4 pp. 1–17.
2. Marmol U., 2017. Wavelet analysis of airborne laser scanning data in the process of automatic extraction of selected objects. Rozprawy Monografie. Wydawnictwa AGH.
3. Lenda G., Marmol U., Mirek G., 2015. Accuracy of laser scanners for measuring surfaces made of synthetic materials. Photogrammetrie Fernerkundung Geoinformation 5, pp. 357–372.

Learning outcomes prescribed to a field of study

Code	Content
RSGI2A_K02	is ready for creative time management, working under time pressure
RSGI2A_U02	can acquire remote environmental data
RSGI2A_U03	is able to process geospatial data and automate data processing in an advanced manner
RSGI2A_U04	is able to use IT tools for spatial data processing
RSGI2A_W01	has a deep knowledge of mathematics in remote sensing data analysis
RSGI2A_W03	has a deep understanding of remote environmental data acquisition methods
RSGI2A_W04	has a deep understanding of methods, algorithms and automation of spatial data processing
RSGI2A_W05	has an enhanced knowledge of the use of computer science in geoscience
RSGI2A_W06	knows selected social, economic and legal aspects of the geo-information society
RSGI2A_W07	knows the basic concepts and principles of intellectual property protection, copyright and patent information resources