



# Data Science for Smart Environment

## Course description sheet

### Basic information

<b>Field of study</b> Remote Sensing and Geo Informatics	<b>Didactic cycle</b> 2025/2026	
<b>Major</b> All	<b>Course code</b> DRSGIS.II2.15496.25	
<b>Organisational unit</b> Faculty of Geo-Data Science, Geodesy, and Environmental Engineering	<b>Lecture languages</b> English	
<b>Study level</b> Second-cycle studies	<b>Mandatoriness</b> Obligatory	
<b>Form of study</b> Full-time studies	<b>Block</b> Core Modules	
<b>Profile</b> General academic	<b>Course related to scientific research</b> Yes	
<b>Course coordinator</b>	Beata Hejmanowska	
<b>Lecturer</b>	Beata Hejmanowska, Wojciech Drzewiecki, Krystyna Michałowska	
<b>Period</b> Semester 2	<b>Method of verification of the learning outcomes</b> Completing the classes	<b>Number of ECTS credits</b> 6
	<b>Activities and hours</b> Lectures: 15 Workshop classes: 60	

### Goals

C1	The aim of the class is to learn about new smart technology such as internet of things, crowd sourcing, social media for the smart environment and decision support.
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### Course's learning outcomes

Code	Outcomes in terms of	Learning outcomes prescribed to a field of study	Methods of verification
<b>Knowledge - Student knows and understands:</b>			
W1	new technology e.g. IoT, smart metering, industry 4.0	RSGI2A_W03, RSGI2A_W04, RSGI2A_W05	Participation in a discussion, Report, Case study, Involvement in teamwork
W2	the roles of social media and ethical issues related to smart environment	RSGI2A_W06, RSGI2A_W07	Participation in a discussion, Report, Case study, Involvement in teamwork
W3	problems related to the processing of large spatial-temporal data	RSGI2A_W03, RSGI2A_W04, RSGI2A_W05	Participation in a discussion, Report, Case study, Involvement in teamwork
<b>Skills - Student can:</b>			
U1	integrate and analyze data obtained from new technologies	RSGI2A_U03, RSGI2A_U04	Case study, Involvement in teamwork
U2	application of machine learning and geo-informatics tools for smart environment development	RSGI2A_U03, RSGI2A_U04	Case study, Involvement in teamwork
<b>Social competences - Student is ready to:</b>			
K1	intentionally use of social media	RSGI2A_K01	Participation in a discussion, Report, Case study, Involvement in teamwork
K2	consciously manage ethical risks with smart technologies	RSGI2A_K01, RSGI2A_K03	Participation in a discussion, Report, Case study, Involvement in teamwork

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

The student will acquire advanced knowledge of the possibilities of using datascience for smart environment. During module, student will gain knowledge of new sources of data, such as the Internet of things and social media. Example use cases: smart environment for improving energy efficiency and citizens' quality of life or applications of IoT technology in urban agglomerations, villages, farms, factories or for fighting climate change.

## Student workload

Activity form	Average amount of hours* needed to complete each activity form
Lectures	15
Workshop classes	60
Realization of independently performed tasks	100

<b>Student workload</b>	<b>Hours</b> 175
<b>Workload involving teacher</b>	<b>Hours</b> 75

\* hour means 45 minutes

### Program content

No.	Program content	Course's learning outcomes	Activities
1.	<p>During lectures, student will gain knowledge of smart technologies, which are new sources of data, such as the Internet of things and social media. Problems related to big data, containing in particular time-varying spatial data, how to analyze and share them, will be presented. Examples will be given of the use of spatial-temporal data for smart environments (e.g. smart environment for improving energy efficiency and citizens' quality of life or applications of IoT technology in urban agglomerations, villages, farms, factories or for fighting climate change). They will also learn about related social and ethical issues.</p> <p>As part of the workshop, students in groups will do a case study project applying spatial data for smart environment, in which they will: 1) define the area of analysis, 2) analyze the available data, 3) design the data to be acquired (own work and crowd sourcing), 3) perform data processing, visualization and sharing, 3) perform impact tests, 4) analyze the results in terms of social, ethical and political aspects and the possibility of influencing the decision making process. During the workshop, students in groups present completed case studies. Each student prepares a written report on his/her part of the activity</p>	W1, W2, W3, U1, U2, K1, K2	Lectures, Workshop classes

### Extended information/Additional elements

#### Teaching methods and techniques :

Workshop, Mentoring, Problem Based Learning, Design thinking, Group work, Case study, E-learning, Discussion, Lectures

Activities	Methods of verification	Credit conditions
Lectures	Participation in a discussion, Case study	Lectures are optional, verification of the knowledge during the exam as part of the transitional work passing.
Workshop	Participation in a discussion, Report, Case study, Involvement in teamwork	Workshops 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

The assessment is based on the case study project done in a group, the individual partial report done by each student (including a description of the work completed by the student individually) and the student's activity in class.

## Method of determining the final grade

Final grade = average of presentation of group workshop, individual report and class activity.

## 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 exercises with the help of individual consultations with the instructor.

## Prerequisites and additional requirements

Knowledge of the courses: 1 semester and 1 block of 2 semester: Machine Learning, applied mathematics and Eeo-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. Data Science for Smart Environment is preceded by blocks: Machine Learning, applied mathematics and Eeo-information Tools. Lecture topics are related to the workshop but expand the knowledge in the topic. Lectures are optional. The student is obliged to learn using the lecture method or by himself. Workshop include the training of practical application of the knowledge and is compulsory.

## Literature

### Obligatory

1. Smart Environment » IoT solutions to fight environmental pollution (libelium.com) Smart Environment » IoT solutions to fight environmental pollution (libelium.com) (access: 25.11.2022)

### Optional

1. Smart Environment: Improving Energy Efficiency & Citizens' life quality (nexusintegra.io)  
<https://nexusintegra.io/smart-environment/>

## Scientific research and publications

### Research

1. 12.06.2016-30.06.2018 - CHT2 - Cultural Heritage Through Time, project no 013/DSAP-JG/HERITAGEPLUS/2016, Joint Programming Initiative on Cultural Heritage and Global Change: a new challenge for Europe HERITAGE PLUS Call, team leader

### Publications

1. Hejmanowska B., Glowienka E., Michalowska K., Mikrut S., Kramarczyk P., Opalinski P., Twardowski M., Guidi G., Gonizzi Barsanti S., Micoli L., Shafqat Malik U., Gonzalez-Aguilera D., Sanchez-Aparicio L.J., Rodríguez-Gonzálveza P.R., Muñoz-Nieto A.L., Mills J., Peppia M.V., 2019 - "The Comparison of the Web GIS Applications Relevant for 4D Models Sharing" - IOP Earth and Environmental Sciences
2. Rodríguez-Gonzálvez P., Muñoz-Nieto A.L, del Pozo S., Sanchez-Aparicio L.J, GonzalezAguilera D., Micoli L., Barsanti S.G, Guidi G., Mills J., Fieber K., Haynes J., Hejmanowska B. 2017 - "4D reconstruction and visualization of cultural heritage: Analyzing our legacy through time", The International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. 42, Copernicus GmbH

## Learning outcomes prescribed to a field of study

Code	Content
RSGI2A_K01	is ready to resolve conflicts, negotiate, work in a team
RSGI2A_K03	maintain an ethical attitude while performing and presenting the results of assigned tasks
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_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