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EcoMinds

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WP4 – Digital Seminar Description - Introduction to Machine Learning for Environmental Data

January 2025.

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Eco Minds

Enhancing Environmental Data Collection through Machine Learning and Database Systems

Work Package:	WP4: Course Development
Product/Deliverable:	Digital Seminar Description

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INTRODUCTION

Course Name: Eco Minds Digital Seminar: Introduction to Machine Learning for Environmental Data

Course Duration: 10 hrs

Level: Undergraduate (EQF 4, with progression pathways towards EQF Level 5)

ECTS Credits: Not applicable

Delivery Mode: Blended/digital format comprising guided online sessions, interactive presentations, practical mini-tasks, discussions, and independent learning activities.

Course Description:

This digital seminar introduces learners to the core concepts of machine learning and environmental data analysis in an accessible and straightforward manner. It emphasizes understanding how data are collected, described, and analyzed, how basic statistical ideas support data interpretation, and how machine learning can be used to classify and predict environmental phenomena.

Using real-world environmental examples, learners examine the role of artificial intelligence in sustainability, environmental monitoring, and responsible decision-making. The seminar is designed as a non-formal learning activity, suitable for secondary education students and outreach efforts, while staying aligned with the objectives of the Eco Minds project.

INTEGRATED COMPETENCIES (LEARNING OUTCOMES)

- **Explain** core concepts of data, statistics, artificial intelligence, and machine learning within the context of environmental data.
- **Explain** the difference between classification and regression tasks using clear real-world examples.
- **Interpret** fundamental statistical summaries (e.g., averages, ranges) of environmental data sets.
- **Identify** typical types and sources of environmental data and describe their importance

for sustainability.

- **Analyze** straightforward examples of machine learning applications in environmental monitoring.
- **Demonstrate** understanding of ethical, social, and environmental impacts of AI-based decision-making.
- **Apply** learned knowledge in guided tasks and familiar learning settings.

COURSE DURATION AND IMPLEMENTATION

The digital seminar involves about 8–10 hours of total learner workload, including roughly 4–5 hours of guided sessions and 4–5 hours of independent and practical learning activities.

As a non-formal learning activity, the seminar does not grant ECTS credits. All materials are created as open educational resources and can be reused or modified by educational institutions for teaching, outreach, or lifelong learning purposes.

PREREQUISITES

Required

- General interest in environmental, climate, or sustainability-related topics
- Basic ability to understand numerical information (tables, simple charts)
- Willingness to engage with digital learning materials

Suggested

- Familiarity with basic data representations (e.g. graphs, averages)
- Curiosity about how digital technologies and AI support environmental protection
- Prior exposure to online learning environmentsPrior exposure to online learning platforms (e.g., Moodle)

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TARGET AUDIENCES

Educators

Secondary school teachers, trainers, and educators interested in integrating machine learning, data literacy, and environmental sustainability concepts via accessible digital learning activities.

Students

Secondary school students and other learners seeking an introductory understanding of machine learning and environmental data without needing a technical or programming background.

LESSON-BY-LESSON TOPICS

Data All Around Us

- What are data?
- Environmental data in everyday life
- Data vs information
- Why does data matter for environmental monitoring

Basic Statistics for Understanding Data

- Why statistics are needed
- Average, minimum, maximum, and range
- Understanding environmental trends through simple numbers

What Is Artificial Intelligence?

- Programs, algorithms, and AI
- Everyday examples of AI
- AI applications in environmental protection

How Machines Learn from Data

- Learning from examples
- Data quality and errors
- Simple learning and prediction scenarios

Machine Learning Tasks

- Classification: assigning data to categories
- Regression: predicting numerical values
- Environmental use cases

Environmental Data in Practice

- Sources of environmental data
- Open data and public datasets
- Mini-task: designing a simple prediction or classification scenario

Responsible Use of AI

- Data privacy and reliability
- Bias and limitations of AI
- AI as a decision-support tool

ASSESSMENT

As a non-formal learning activity, the digital seminar does not involve formal grading. Learner engagement and progress are facilitated through formative activities such as guided discussions, short quizzes, reflection tasks, and practical mini-assignments. These activities help reinforce conceptual understanding and promote critical thinking about the application of machine learning in environmental contexts.

CREDENTIALS

Upon successfully completing the digital seminar, participants will receive a digital badge or certificate of participation that confirms the achievement of the specified learning outcomes. This credential aligns with the European approach to micro-credentials and lifelong learning by promoting transparency, portability, and recognition of non-formal learning accomplishments.

COURSE RESOURCES AND MATERIALS

All course materials and activities are accessible through the Moodle Learning Management System (LMS), which offers a structured way to access lectures, exercises, quizzes, and project assignments. Participants can engage in the course through both guided and self-paced formats. The LMS guarantees equal access, transparency, and consistent learning resources, supporting the EU's goals for digital and green transformation through technology-enhanced education.

Registration and LMS instructions are accessible online at the link.

REFERENCES

The following open-access, freely available resources are a carefully selected set of introductory materials that support the content of the digital seminar. They offer clear explanations of key concepts in machine learning, basic statistics, and environmental data analysis, emphasizing understanding over technical details.

These resources are intended as optional reading for learners and educators who want to explore the topics introduced in the seminar further. Their open-access nature improves accessibility and inclusiveness, supporting the principles of open education, non-formal learning, and lifelong learning promoted within the European Education Area.

Online Learning Resources

(Optional reading – not required for successful completion of the digital seminar)

[1] **G. James, D. Witten, T. Hastie, and R. Tibshirani**, An Introduction to Statistical

Learning, 2nd ed. (*Selected introductory chapters on classification and regression*),

[2] Available:https://hastie.su.domains/ISLR2/ISLRv2_website.pdf

A. Bassens, G. Beyleveld, and J. Krohn, Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence. (Conceptual and visual explanations only), Available: https://dokumen.pub/deep-learning-illustrated-a-visual-interactive-guide-to-artificial-intelligence-paperbacknbsped-0135116694-9780135116692-l-4514272.html

[3] **K. Cho**, *Brief Introduction to Machine Learning without Deep Learning*. (Basic intuition for statistics and data understanding), Available: https://github.com/nyu-dl/Intro_to_ML_Lecture_Note/raw/master/lecture_note.pdf

[4] **S. H. Chan**, Introduction to Probability for Data Science, Available: https://probability4datascience.com/index.html

Additional Resources for Educators

(For further reading and content extension – not intended for learners)

[5] **Lindholm, N. Wahlström, F. Lindsten, and T. B. Schön**, Machine Learning – A First Course for Engineers and Scientists, Available: http://smlbook.org/book/sml-book-draft-latest.pdf

[6] **T. Hastie, R. Tibshirani, and J. Friedman**, The Elements of Statistical Learning, Available: https://hastie.su.domains/ElemStatLearn/printings/ESLII_print12.pdf