



Machina Learning Skills for ICT Professionals



PROJECT PROGRESS AND SECOND SEMESTER RESULTS



Erasmus+

MACHINA key project details

- **Project code:** 2020-1-FR01-KA202-080386
- **Project duration:** 28 months
 - **Start date:** 01 September 2020
 - **End date:** 31 December 2022
- **Budget:** 300K €
- **Funding Program:** ERASMUS+





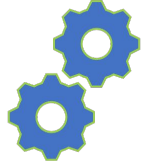
MACHINA Project Goals

- ❑ Design a joint VET curriculum in ML, to empower ICT workers with sought-after technical, non-technical and meta (soft) skills.
- ❑ Introduce flexible training delivery methods and innovative open access pedagogical resources to support VET provision and ML skills acquisition.
- ❑ Foster the recognition and integration of ML skills requirements into sectoral competence frameworks & certification schemes.
- ❑ Improve ML labour market & skills intelligence at the EU level.
- ❑ The project starts in September 2020 and will finish in December 2022.

Target Group

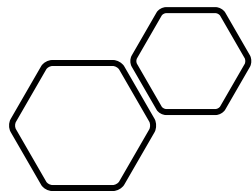
- Educational/Training providers.
- ICT workers in need of C-VET.
- I-VET students.
- Sector representatives and social partners.
- Public educational and accreditation authorities.





MAIN Outputs

- O1: MACHINE Learning (ML) learning outcomes.***
- O2: MACHINA curriculum structure and Open Educational Resources.***
- O3: Vocational Open Online Course (VOOC) infrastructures.
- O4: Framework for the recognition and integration of ML skills. requirements into certification & standardization schemes.
- E1- E5: MACHINA National Information Days.



ACTIVITY PROGRESS

□ **During the last few months of the project, MACHINA partners did:**

□ **O1: MACHINE Learning (ML) learning outcomes.**

- Collected evidence on workplace requirements regarding ML skills.
- Defined MACHINA learning outcomes based on the analysis of the collected evidence and identifying the, knowledge, skills, and competences needed for each unit.

Module 4 Deep Learning (Advanced)			
Learning outcomes correspond to EQF Level 4-5			
Knowledge	Skills	Competence	
<p>Fundamental concepts of neural networks:</p> <ul style="list-style-type: none">- Perception- Activation functions- Cost functions- Learning- Gradient descent- Multi-layer perceptron and its universality- Parameters and hyper-parameters <p>- When to use neural networks:</p> <ul style="list-style-type: none">- Interpretability of a machine learning model- Assumptions on the model underlying the dataset- The black-box- What is our goal? (description)	<p>To use a framework to implement, train and validate a machine learning model using existing neural networks development framework (Pytorch, Tensorflow, Keras, Scikit-learn, etc...)</p>	<p>To understand which class of problems could be actually solved with (and only with) a deep learning approach</p>	<p>To design and develop a deep learning model to solve those problems</p> <p>To optimize the used technology for best performances (using scalable technologies, fine tuning parameters and hyper-parameters)</p>



MACHINA

**Definition of MACHINA learning
outcomes based on training needs
analysis (O1-T4-b)**

Output type: Intellectual Output

UCBL
February 2021

ACTIVITY PROGRESS

❑ *During the last few months of the project, MACHINA partners did:*

❑ *O2: MACHINA curriculum structure and Open Educational Resources.*

- ❑ Design of curriculum structure by grouping of learning outcomes into units
- ❑ Start developing educational resources.
- ❑ Each learning unit will have at least:
 - ❑ 1 introductory paragraph for each lesson in a learning unit
 - ❑ 3-4 pages of lecture notes for each lesson in a learning unit
 - ❑ 1 presentation file with 15-20 slides for each lesson in a learning unit
 - ❑ 10 Questions and Answers for each learning unit
 - ❑ 2 Case Studies for each learning unit
 - ❑ 2 practical exercises (for the entire unit)
 - ❑ 15 multiple choice questions (for the entire unit)



Lesson 1: Introduction to Machine Learning

LU1: ML ESSENTIALS FOR ICT PROFESSIONALS



MACHINA Curriculum Outline

Learning Unit 1: **ML Essentials for ICT professionals (EQF-5)**

- Lesson 1: Introduction to Machine Learning (19 slides)
- Lesson 2: Where to Apply ML (15 slides)
- Lesson 3: Machine Learning and Data Processing (17 slides)
- Lesson 4: Example ML Applications (15 slides)

Learning Unit 3: **ML Algorithms, Programs And Protocols (EQF-5)**

- Lesson 1: Machine Learning by Linear Models (20 slides)
- Lesson 2: Supervised Learning Algorithms (25 slides)
- Lesson 3: Unsupervised Learning Algorithms (26 slides)
- Lesson 4: Semi-supervised Learning (20 slides)
- Lesson 5: Best Practices for ML (19 slides)
- Programming Languages and Frameworks for ML (21 slides)

Learning Unit 2: **Mathematical Foundations (EQF-5)**

- Lesson 1: Sets, Relations, Functions, Derivatives (19 slides)
- Lesson 2: Linear Algebra (10 slides)
- Lesson 3: Probability Theory (12 slides)
- Lesson 4: Statistics (19 slides)
- Lesson 5: Computation Theory (12 slides)

MACHINA Curriculum Outline

Learning Unit 4: **Deep Learning (Advanced)** (EQF-5)

- Lesson 1: Multilayer Perceptron (MLP) (26 slides)
- Lesson 2: Convolutional Neural Networks (CNN) (18 slides)
- Lesson 3: Recurrent Neural Networks (RNN) (13 slides)
- Lesson 4: Autoencoders, Restricted Boltzmann Machines (9 slides)

Learning Unit 5: **Communicating The Merits, Challenges And Implications Of Machine Learning Technology To Customers And Within Own Organisation** (EQF-5)

- Lesson 1: Introduction to Effective Communication (12 slides)
- Lesson 2: Core Types and levels of effective communication and ways for using Machine Learning in Communications (13 slides)
- Lesson 3: The future of communication in accordance with artificial intelligence (12 slides)
- Lesson 4: The effects of artificial intelligence in communication (10 slides)

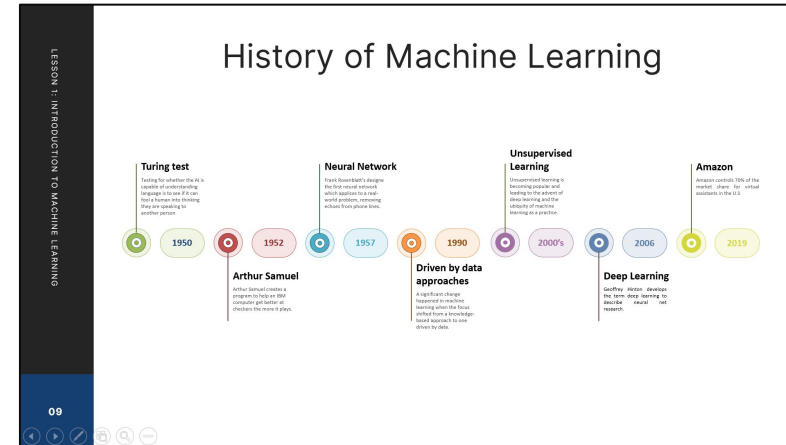
Learning Unit 6: **EU guidelines on ethics in artificial intelligence** (EQF-6)

- Lesson 1: EU guidelines on ethics in artificial intelligence (16 slides)
- Lesson 2: Data Value/Costs Model (18 slides)
- Lesson 3: Bias in Machine Learning (17 slides)
- Lesson 4: Software Engineering for AI applications (17 slides)

Educational resources

Learning unit 1 consists of:

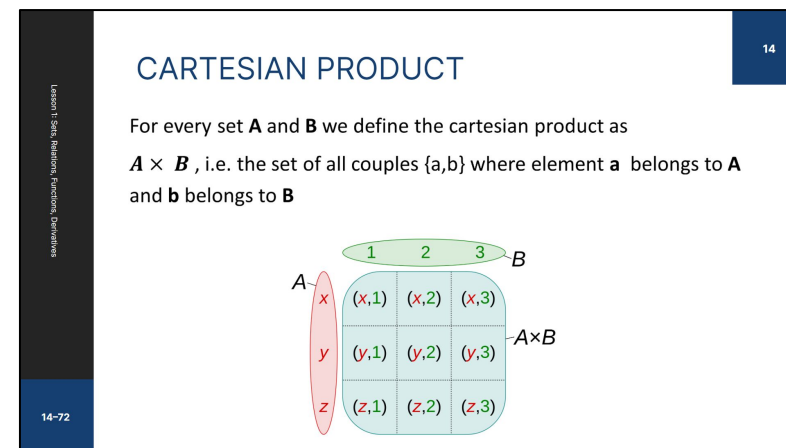
- ✓ 13 pages of lecture notes
- ✓ 66 presentation slides
- ✓ 10 questions and answers
- ✓ 2 case studies
- ✓ 2 exercises
- ✓ 10 multiple choice questions



Lesson 1: Introduction to Machine Learning

For the Learning unit 2 were developed:

- ✓ 13 pages of lecture notes
- ✓ 66 presentation slides
- ✓ 10 questions and answers
- ✓ 2 case studies
- ✓ 2 exercises
- ✓ 10 multiple choice questions



Lesson 1: Sets, Relations, Functions, Derivatives

Educational resources

Learning unit 3 has:

- ✓ 19 pages of lecture notes
- ✓ 131 presentation slides
- ✓ 15 questions and answers
- ✓ 2 case studies
- ✓ 3 exercises
- ✓ 15 multiple choice questions

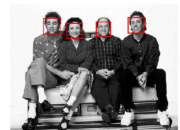
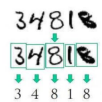
For the Learning unit 4 were created:

- ✓ 24 pages of lecture notes
- ✓ 66 presentation slides
- ✓ 18 questions and answers
- ✓ 2 case studies
- ✓ 2 exercises
- ✓ 15 multiple choice questions

04

Classification

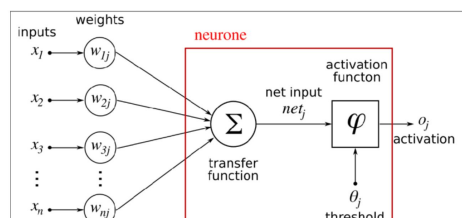
- Classification is the task used to predict an output label for a given input example.
- Example of classification
 - Classification of defective components
 - Fraud Detection
 - face recognition
 - Handwriting recognition



Lesson 1: Machine Learning by Linear Models

05

PERCEPTRON



To have a classifier or a non-linear regressor the activation function has to be a non-linear function, usually a sigmoid function. The transfer function is a linear combination of inputs and weights.

05-26

Lesson 1: Multilayer Perceptron (MLP)

Educational resources

Learning unit 5 consists of:

- ✓ 35 pages of lecture notes
- ✓ 47 presentation slides
- ✓ 9 questions and answers
- ✓ 2 case studies
- ✓ 2 exercises
- ✓ 12 multiple choice questions

Learning unit 6 has:

- ✓ 15 pages of lecture notes
- ✓ 68 presentation slides
- ✓ 9 questions and answers
- ✓ 2 case studies
- ✓ 2 exercises
- ✓ 11 multiple choice questions

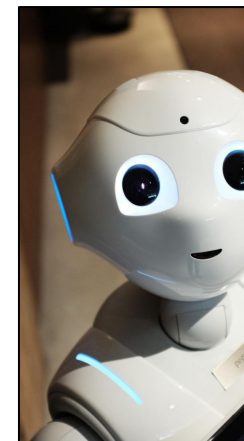


Definitions of different authors

04

- 01 Ordway Tead**
"Communication is a composite of (a) information given and received, (b) of a learning experience in which certain attitudes, knowledge and skills change, carrying with them alternations of behaviour, (c) of a listening effort by all involved, (d) of a sympathetic fresh examination of issues by communicator himself, (e) of a sensitive interaction of points of view leading to a higher level of shared understanding and common intention."
- 02 G.G. Brown.**
"Communication is transfer of information from one person to another, whether or not it elicits confidence. But the information transferred must be understandable to the receiver."
- 03 Louis A. Allen**
"Communication is the sum of all the things one person does when he wants to create understanding in the mind of another. It is a bridge of meaning. It involves a systematic and continuous process of telling, listening and understanding."
- 04 Fred G. Meyer**
"Communication is the intercourse by words, letters or messages".
- 05 Keith Davis**
"Communication is the process of passing information and understanding from one person to another."

Lesson 1: Introduction to Effective Communication



GDPR checklist

04

<https://gdpr.eu/checklist/>

GDPR checklist can help you secure your organization, protect your customers' data, and avoid costly fines for non-compliance.

- Lawful basis and transparency
- Data security
- Privacy rights

Lawful basis and transparency

- Conduct an information audit to determine what information you process and who has access to it.
- Have a legal justification for your data processing activities.
- Provide clear information about your data processing and legal justifications to your privacy policy.

Organizations that have at least 250 employees or conduct higher-risk data processing are required to keep an up-to-date and detailed list of their accessible and the procedures to show that it is in compliance with requirements. The best way to demonstrate GDPR compliance is using a data protection impact assessment. Organizations with fewer than 250 employees should also conduct an assessment because it will make complying with the GDPR's other requirements easier. In your list, you should include: the purpose of the processing, what kind of data you process, who has access to it in your organization, any third parties and when they are included that have access, what you're doing to protect the data (e.g. encryption) and when you plan to erase it if possible.

Lesson 1: EU guidelines on ethics in artificial intelligence

2nd Project Meeting

- The second project meeting was planned to be held in Hannover, Germany. However, due to the current situation of COVID-19, it was organized online. The first intellectual output, “Learning outcome,” was presented and discussed based on the survey findings and the research held during the first semester. The virtual meeting was successfully held, and the next semester plan was introduced and discussed with all the partners.

The methodology

- O2 - T1 includes also the delivery of a methodology for the validation of MACHINA learning outcomes acquired in both formal & non-formal settings.

The methodology will prescribe

- assessment processes* (MCQ tests or/and practical examination) and examination materials (pool of questions/exercises of the same proficiency level regularly updated and randomly selected)
- recommend *certified qualification bodies* to host validation procedures, and
- define the processes (MoU, learning agreement) for the *recognition, transfer & accumulation* of learning outcomes between E&T providers.

Participant thumbnails: PARISA GHODD, Raneen, Diomyios Sol, ANDRES BANTA, Alexandre D..., Vassilios Kostis, Cédric Rivest, khalid

Time / Duration	Topic	Who
10:00 - 10:30	OPENING OF THE MEETING - Official welcome, presentation of the meeting's agenda	UCRL
10:30 - 10:40	1. PMW WORKPLAN REVIEW - Recap and overview of activities implemented up to now - Presentation of the new tasks set partner with focus on the 2 nd semester	EREVA
10:40 - 11:30	2. O1: MACHINE LEARNING (ML) LEARNING OUTCOMES - Presentation of data collection results and analysis process - Presentation and discussion of learning outcomes	UCRL
11:30 - 11:40	3. O2: THE GROUPING OF LEARNING OUTCOMES INTO UNITS - Indicate structure and layout - Discussion and exchange of ideas	ACADEMY
11:40 - 12:00	SHORT BREAK	
12:00 - 12:30	4. O3: T&A VALIDATION METHODOLOGY - Indicate structure and layout - Discussion and exchange of ideas	ANC
12:30 - 12:45	5. O4: T&A MACHINA TRAINING & ASSESSMENT MATERIAL	ACADEMY /

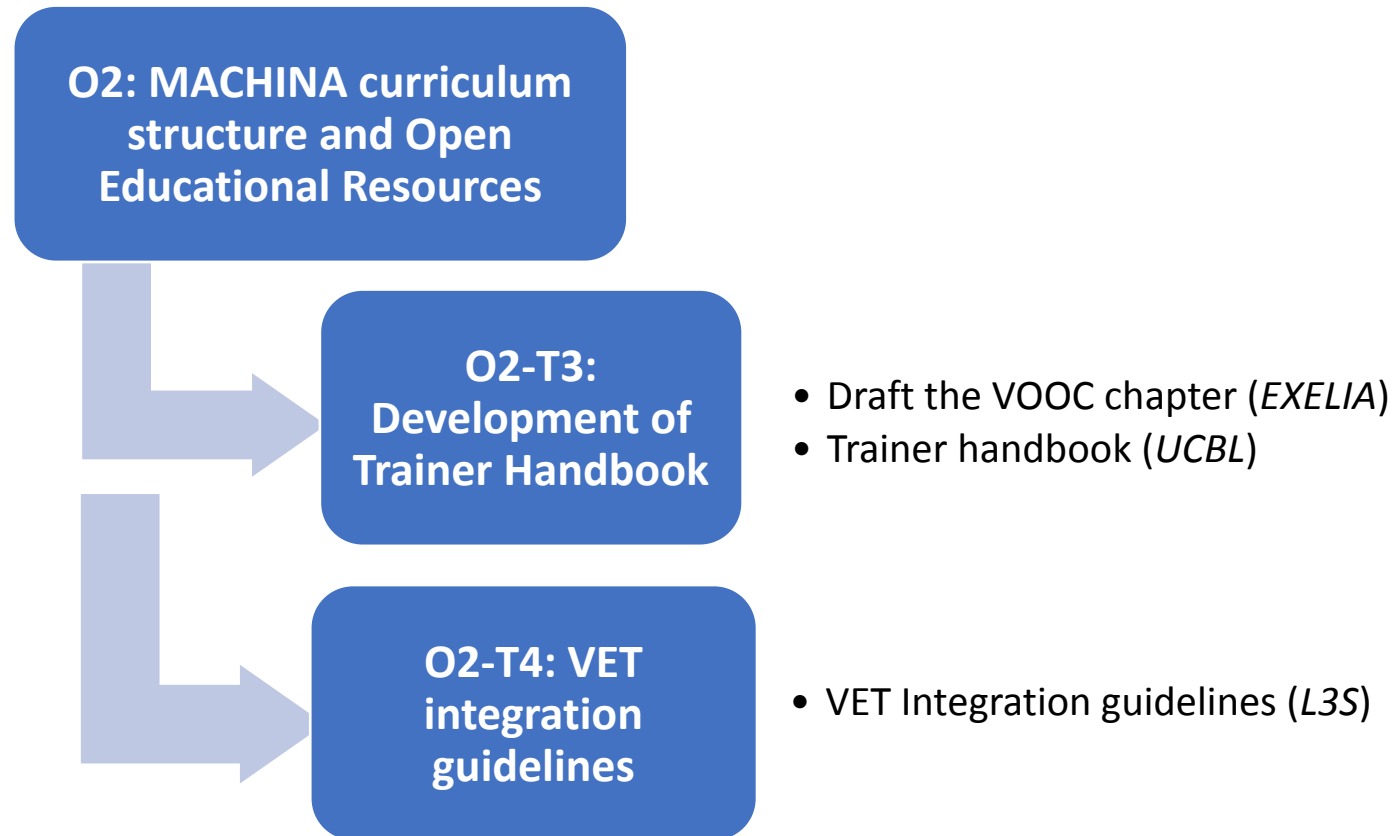
Participant thumbnails: Alexandre D..., C

Participant thumbnails: Frédéric Bien...

2nd Semester Outcome

- The second Semester of the Machina project outcome are:
 - Report presenting the grouping of learning outcomes into learning units, and each unit's specifications.
 - The educational resources for each of the defined learning units, that include slides, lecture notes file, exercises, use cases, and Questions and Answers.
- The next partner meeting will take place in October 2021, in Athens, Greece.

The main upcoming tasks for the 3^d semester



The main upcoming tasks for the 3^d semester

O3: Vocational Open Online Course (VOOC) infrastructures

O3-T1: Preparation and deployment of MACHINA VOOC infrastructures

- Identification of suitable VOOC platforms (*EXELIA*)
- Development of VOOC infrastructures in 6 languages (*EXELIA*)
- Creation of descriptive materials (*EXELIA*)
- Collectively decide on platform (*All partners*)

O3-T2: Development of additional pedagogical VOOC materials

- Development of 1 work assignment and 1 video for Lessons 1-4 (*L3S*)
- Development of 1 work assignment and 1 video for Lessons 5-7, 1 introductory video (*ACADEMY*)
- Development of a certificate template (*EXELIA*)
- Translation of work assignments and video subtitles (*All partners*)

Partners

UCBL - Lyon, France



ACADEMY - Rome, Italy



ANC - Bucharest, Romania



EXELIA - Athens, Greece



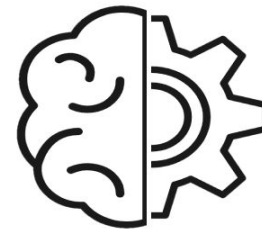
L3S - Hannover, Germany



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