MACHINA

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.

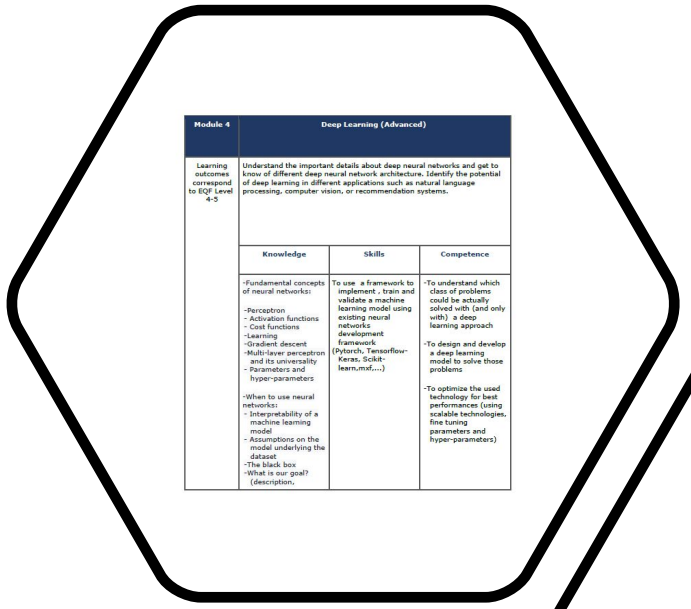
Target Group

- 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



Module 4	Deep Learning (Advanced)		
Learning outcomes correspond to EQF Level 4-5	Understand the important details about deep neural networks and get to know of different deep neural network architecture. Identify the potential of deep learning in different applications such as natural language processing, computer vision, or recommendation systems.		
	Knowledge	**Skills**	**Competence**
	-Fundamental concepts of neural networks: -Perceptron - Activation functions - Cost functions -Learning -Gradient descent -Multi-layer perceptron and its universality - Parameters and hyper-parameters -When to use neural networks: - Interpretability of a machine learning model - Assumptions on the model underlying the dataset -The black box -What is our goal? (description,	To use a framework to implement , train and validate a machine learning model using existing neural networks development framework (Pytorch, Tensorflow-Keras, Scikit-learn,mxf,...)	-To understand which class of problems could be actually solved with (and only with) a deep learning approach -To design and develop a deep learning model to solve those problems -To optimize the used technology for best performances (using scalable technologies, fine tuning parameters and hyper-parameters)

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

Output type: Intellectual Output

UCBL

February 2021

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- ***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.

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)

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 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)

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)

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)

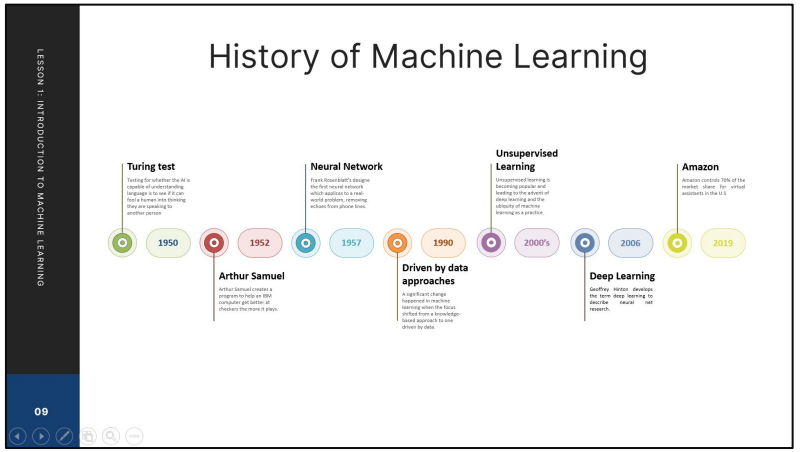
Learning Unit 6: **EU guidelines on ethics in artificial intelligence** **(EQF-6)**

- 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:

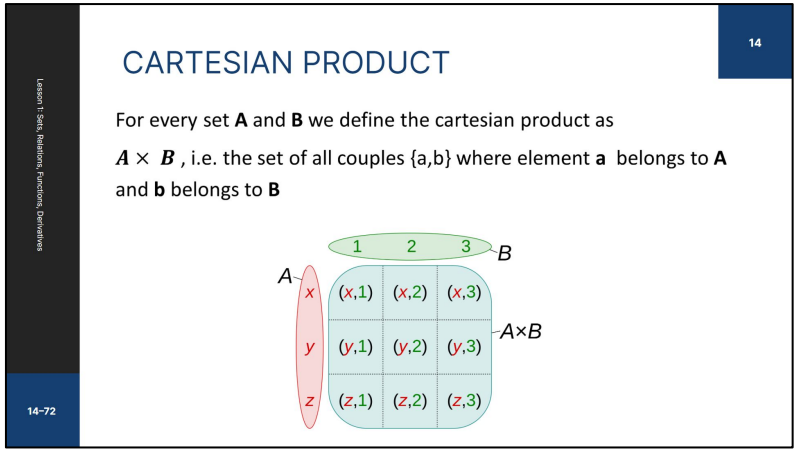
- ✔ 13 pages of lecture notes
- ✔ 66 presentation slides
- ✔ 10 questions and answers
- ✔ 2 case studies
- ✔ 2 exercises
- ✔ 10 multiple choice questions



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

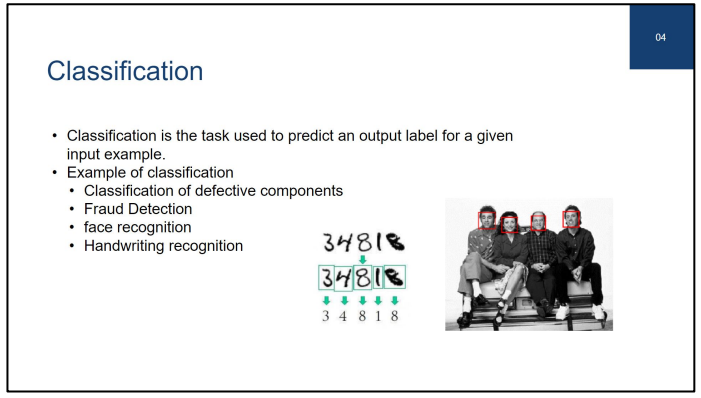
Educational resources

Learning unit 3 has:

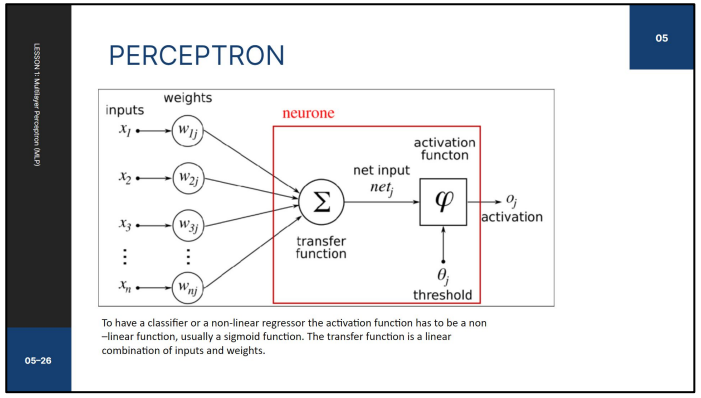
- ✔ 19 pages of lecture notes
- ✔ 131 presentation slides
- ✔ 15 questions and answers
- ✔ 2 case studies
- ✔ 3 exercises
- ✔ 15 multiple choice questions

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



Lesson 1: Machine Learning by Linear Models

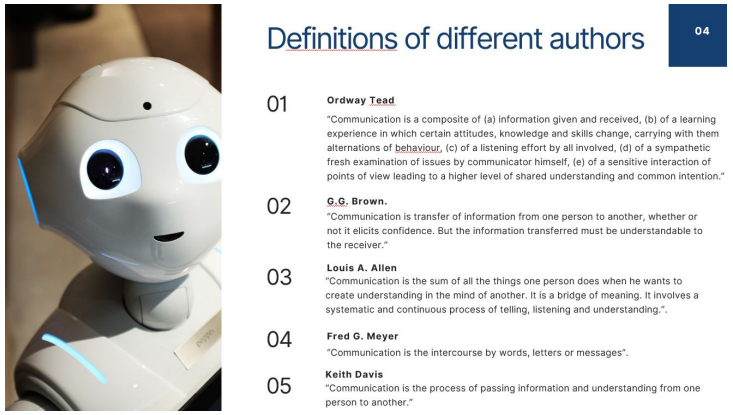


Lesson 1: Multilayer Perceptron (MLP)

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



Lesson 1: Introduction to Effective Communication

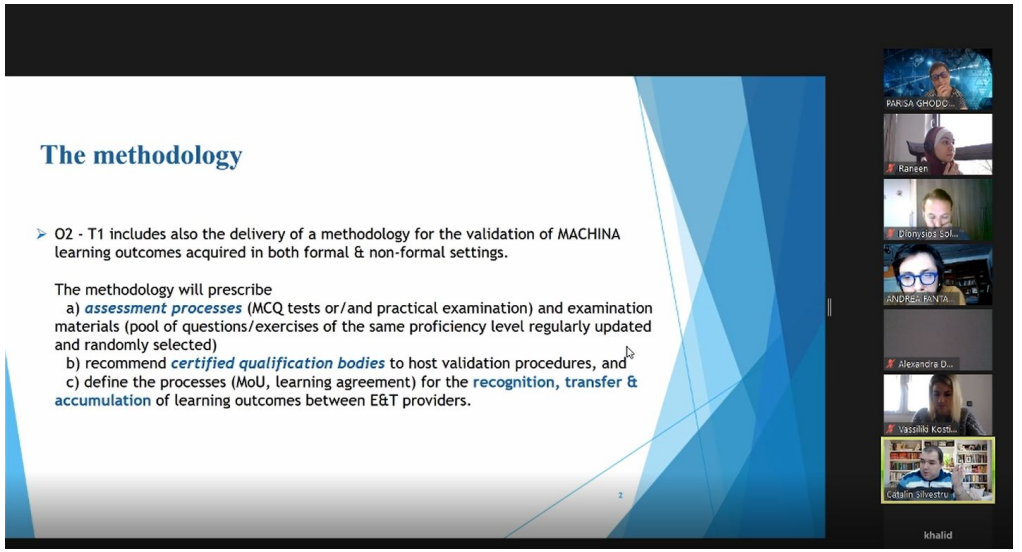
Learning unit 6 has:

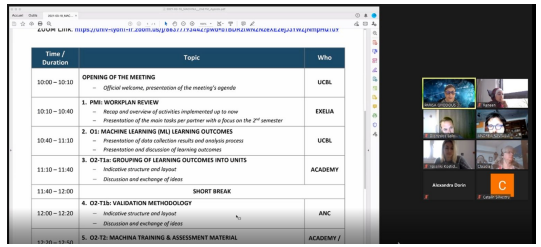
- ✔ 15 pages of lecture notes
- ✔ 68 presentation slides
- ✔ 9 questions and answers
- ✔ 2 case studies
- ✔ 2 exercises
- ✔ 11 multiple choice questions

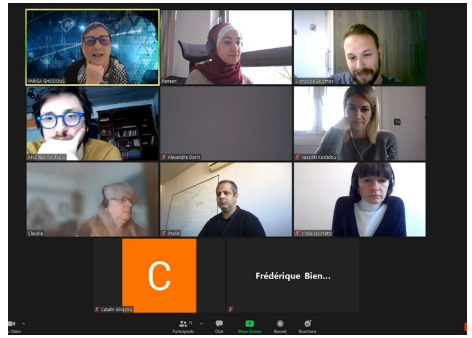
Lesson 1: EU guidelines on ethics in artificial intelligence

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.





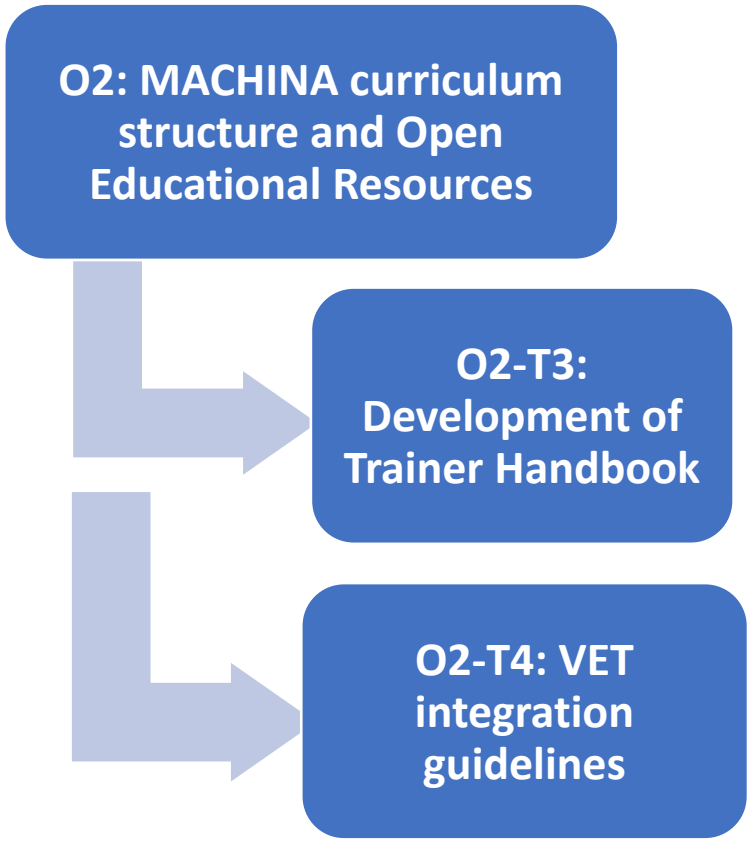


2nd Semester Outcome

- 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



- Draft the VOOC chapter (*EXELIA*)
- Trainer handbook (*UCBL*)

- VET Integration guidelines (*L3S*)

The main upcoming tasks for the 3d 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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