



INTERNATIONAL
CAMPUS OF
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COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingeniería y Sistemas
de Telecomunicación

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

595330066 - Introduction To Machine Learning

DEGREE PROGRAMME

59ET - Doble Grado en Ing.electrónica de Comunicaciones y en Ing.telemática

ACADEMIC YEAR & SEMESTER

2020/21 - Semester 1

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Learning guide

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1. Description

1.1. Subject details

| | |
|---------------------------------------|---|
| Name of the subject | 595330066 - Introduction To Machine Learning |
| No of credits | 3 ECTS |
| Type | Optional |
| Academic year of the programme | Fourth year |
| Semester of tuition | Semester 7 |
| Tuition period | September-January |
| Tuition languages | English |
| Degree programme | 59ET - Doble Grado en Ing.electrónica de Comunicaciones y en Ing.telemática |
| Centre | 59 - Escuela Técnica Superior de Ingeniería y Sistemas de Telecomunicación |
| Academic year | 2020-21 |

2. Faculty

2.1. Faculty members with subject teaching role

| Name and surname | Office/Room | Email | Tutoring hours * |
|--|--------------------|--------------------------|---|
| Miguel Chavarrias Lapastora (Subject coordinator) | A4204 | miguel.chavarrias@upm.es | Tu - 15:30 - 17:30 Schedules are subject to possible changes. Please, confirm the latest version with the lecturer |

| | | | |
|-------------------------|-------|-----------------------|---|
| Eduardo Juarez Martinez | A4204 | eduardo.juarez@upm.es | W - 08:30 - 10:30 Schedules are subject to possible changes. Please, confirm the latest version with the lecturer |
|-------------------------|-------|-----------------------|---|

* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

3. Prior knowledge recommended to take the subject

3.1. Recommended (passed) subjects

The subject - recommended (passed), are not defined.

3.2. Other recommended learning outcomes

- Programming and debugging using C language and optionally Python

4. Skills and learning outcomes *

4.1. Skills to be learned

CE B2 - Conocimientos básicos sobre el uso y programación de los ordenadores, sistemas operativos, bases de datos y programas informáticos con aplicación en ingeniería.

CG 02 - Capacidad de búsqueda y selección de información, de razonamiento crítico y de elaboración y defensa de argumentos dentro del área.

CG 03 - Capacidad para expresarse correctamente de forma oral y escrita y transmitir información mediante documentos y exposiciones en público.

CG 04 - Capacidad de abstracción, de análisis y de síntesis y de resolución de problemas.

CG 05 - Capacidad de trabajo en equipo y en entornos multidisciplinares.

CG 06 - Capacidad de adaptación, negociación, resolución de conflictos y de liderazgo.

CG 07 - Capacidad para el diseño, la gestión y la dirección de proyectos.

CG 08 - Capacidad de organización, planificación y de toma de decisiones.

CG 12 - Habilidad para las relaciones interpersonales y el trabajo en un contexto nacional e internacional, con capacidad para expresarse de forma oral y escrita en lengua inglesa.

CG 13 - Habilidades de aprendizaje con un alto grado de autonomía.

4.2. Learning outcomes

RA757 - Capacidad para utilizar herramientas CAD para la construcción de redes neuronales

RA753 - Capacidad para conocer, entender y utilizar redes neuronales en el contexto del aprendizaje máquina

RA758 - Capacidad para utilizar aceleradores hardware para el desarrollo de redes neuronales

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

5. Brief description of the subject and syllabus

5.1. Brief description of the subject

The course is focused on introducing the basic concepts related to machine learning. As it is intended to provide an introduction, during the first part of the course the fundamentals related to the development of machine learning algorithms and some use-cases will be explained. The course approach is eminently practical and is based on a Neural Compute Stick module especially devoted to the development of neural networks for computer vision.

The methodology of the course is project-based. The course is divided in two parts: In the first part, basic machine learning concepts will be introduced. Specifically, the fundamental ideas of neural networks will be reviewed. In addition, groups of students will be established to collaborately review different parts of the project proposal. The results will be shared with the student colleagues in a presentation. The second part of the course will be focused on the project proposal. Besides a presentation, students are required to write a report of achieved results.

5.2. Syllabus

1. Introduction to Machine Learning: basic concepts
2. Neural networks development with a Neural Compute Stick module
 - 2.1. Neural networks basic concepts and use cases
 - 2.2. Working environment based on OpenVINO
 - 2.3. Movidius NCS module features
 - 2.4. Movidius NCS module hands-on: examples
3. Neural network project

6. Schedule

6.1. Subject schedule*

| Week | Face-to-face classroom activities | Face-to-face laboratory activities | Distant / On-line | Assessment activities |
|------|-----------------------------------|------------------------------------|--|--|
| 1 | | | Introduction to Machine Learning basic concepts Duration: 02:00 | |
| 2 | | | Introduction to Neural networks: basic concepts and relevant use cases Duration: 02:00 | |
| 3 | | | Introduction to Neural networks: basic concepts and relevant use cases Duration: 02:00 | |
| 4 | | | Introduction to OpenVINO and Movidius framework Duration: 02:00 | |
| 5 | | | Movidius NCS module hands-on lab. Duration: 02:00 | |
| 6 | | | Movidius NCS module hands-on lab. Duration: 02:00 | |
| 7 | | | Movidius NCS module hands-on lab. Duration: 02:00 | |
| 8 | | | | Presentation: initial approach of the project. Continuous assessment Presential Duration: 02:00 Initial report of the project. Continuous assessment Not Presential Duration: 00:00 |
| 9 | | | Movidius NCS module hands-on lab. Duration: 02:00 | |
| 10 | | | Final project development Duration: 02:00 | |

| | | | | |
|----|--|--|---|---|
| 11 | | | Final project development Duration: 02:00 | |
| 12 | | | Final project development Duration: 02:00 | |
| 13 | | | | Final project presentation Continuous assessment Presential Duration: 02:00 Final report of the project Continuous assessment Not Presential Duration: 00:00 |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | Evaluation of the project Final examination Presential Duration: 01:00 Written exam. Machine Learning and neural networks fundamentals. Final examination Presential Duration: 01:00 |

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

7. Activities and assessment criteria

7.1. Assessment activities

7.1.1. Continuous assessment

| Week | Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|------|--|----------|---------------|----------|--------|---------------|--|
| 8 | Presentation: initial approach of the project. | | Face-to-face | 02:00 | 15% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 05 CG 04 CG 06 CG 07 CG 03 CG 12 |
| 8 | Initial report of the project. | | No Presential | 00:00 | 15% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 05 CG 04 CG 06 CG 07 CG 03 CG 12 |
| 13 | Final project presentation | | Face-to-face | 02:00 | 30% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 05 CG 04 CG 06 CG 07 CG 03 CG 12 |
| 13 | Final report of the project | | No Presential | 00:00 | 40% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 05 CG 04 CG 06 CG 07 CG 03 |

CG 12

7.1.2. Final examination

| Week | Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|------|--|----------|--------------|----------|--------|---------------|--|
| 17 | Evaluation of the project | | Face-to-face | 01:00 | 70% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 04 CG 07 CG 03 CG 12 |
| 17 | Written exam. Machine Learning and neural networks fundamentals. | | Face-to-face | 01:00 | 30% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 04 CG 07 CG 03 CG 12 |

7.1.3. Referred (re-sit) examination

| Description | Modality | Type | Duration | Weight | Minimum grade | Evaluated skills |
|--|----------|--------------|----------|--------|---------------|--|
| Written exam. Machine Learning and neural networks fundamentals. | | Face-to-face | 01:00 | 30% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 04 CG 07 CG 03 CG 12 |
| Evaluation of the project | | Face-to-face | 01:00 | 70% | / 10 | CE B2 CG 08 CG 02 CG 13 CG 04 CG 07 CG 12 |

7.2. Assessment criteria

- Continuous assessment will be based on the work done in class during the team sessions, intermediate presentation and portfolios and the final group presentations.

8. Teaching resources

8.1. Teaching resources for the subject

| Name | Type | Notes |
|-------------------------------|--------------|---|
| Movidius Neural Compute Stick | Web resource | https://software.intel.com/content/www/us/en/develop/articles/intel-movidius-neural-compute-stick.html |

9. Other information

9.1. Other information about the subject

This course will be taught in English language. All the materials will be exclusively provided in English language.