

Course guide

230325 - IDL - Introduction to Deep Learning

Last modified: 25/05/2023

Unit in charge:	Barcelona School of Telecommunications Engineering	
Teaching unit:	739 - TSC - Department of Signal Theory and Communications.	
Degree:	BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject). BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Optional subject). BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018). (Optional subject).	
Academic year: 2023	ECTS Credits: 2.0	Languages: English

LECTURER

Coordinating lecturer:	Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others:	Consultar aquí / See here: https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

PRIOR SKILLS

It is advisable to have some background in machine learning. Students will also develop their projects in Python, so previous contact with this language is recommended.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE1. Ability to apply information theory methods, adaptive modulation and channel coding, as well as advanced techniques of digital signal processing to communication and audiovisual systems.

Transversal:

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Application classes
- Group work
- Group work (distance)

LEARNING OBJECTIVES OF THE SUBJECT

The aim of this course is to train students in methods of deep learning. Neural Networks will be presented and analyzed in detail to understand the potential of these state of the art tools. Engineering tips and scalability issues will be addressed to solve tasks such as classification and regression. Hands-on sessions will provide development skills so that attendees can become competent in contemporary data analytics tools.

STUDY LOAD

Type	Hours	Percentage
Self study	30,0	60.00
Hours large group	10,0	20.00
Hours small group	10,0	20.00

Total learning time: 50 h

CONTENTS

Deep Neural Networks

Description:

- Architectures: MLP, CNN, LSTM, GRU, ...
- Training: datasets, back-propagation, optimization,...
- Learning: supervised/unsupervised, adversarial, transfer...
- Attention models

Specific objectives:

At the end of this course, students will be familiar with the state of the art techniques based on deep learning architectures.

Full-or-part-time: 22h

Theory classes: 6h

Laboratory classes: 6h

Self study : 10h

Applications to Speech and Language

Description:

- Natural Language Processing
- Machine Translation
- Speech recognition
- Speaker recognition
- Speech synthesis
- Multimodal: language and vision.
- Frameworks and tools: TensorFlow, Keras, Kaldi

Full-or-part-time: 28h

Theory classes: 6h

Laboratory classes: 6h

Self study : 16h



GRADING SYSTEM

Lectures: 45%

Lab: 45%

Communication: 10%

Attendance: -10% of the maximum grade per missed day

BIBLIOGRAPHY

Basic:

- Goodfellow, I.; Bengio, Y.; Courville, A. Deep Learning [on line]. Cambridge, Massachusetts: The MIT Press, [2016] [Consultation: 24/03/2021]. Available on: <http://www.deeplearningbook.org/>. ISBN 9780262035613.

Complementary:

- Bruna, J. Topics Course on Deep Learning : course [on line]. UC Berkeley, 2016 [Consultation: 05/09/2016]. Available on: <https://github.com/joanbruna/stat212b>.

- Batra, D. Deep Learning for Perception : course [on line]. Blacksburg, VA, USA: Virginia Tech, 2015 [Consultation: 22/11/2016]. Available on: <https://computing.ece.vt.edu/~f15ece6504/>.

- Courville, A.; Bengio, Y. Deep Learning Summer School : course [on line]. Montreal, Quebec: CIFAR, ICRA, CRM, 2016 [Consultation: 05/09/2016]. Available on: <https://sites.google.com/site/deeplearningsummerschool2016/home>.

- Giró-i-Nieto, X.; Sayrol, E.; Salvador, A.; Torres, J.; Mohedano, E.; McGuinness, K.. Deep Learning for Computer Vision [on line]. Barcelona: UPC, 2016 [Consultation: 05/09/2016]. Available on: <http://imatge-upc.github.io/telecombcn-2016-dlcv/>.

RESOURCES

Other resources:

The details of this course are available and updated online at: <https://telecombcn-dl.github.io/2021-idl/>