Last update: 06-05-2019

230325 - IDL - Introduction to Deep Learning

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering

Teaching unit: 739 - TSC - Department of Signal Theory and Communications

Academic year: 2019

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional)

ECTS credits: 2 Teaching languages: English

Teaching staff

Coordinator: Giró Nieto, Xavier

Others: Ruiz Costa-Jussa, Marta
Sayrol Clols, Elisa
Giró Nieto, Xavier
Vilaplana Besler, Veronica
Morros Rubio, Josep Ramon
Ruiz Hidalgo, Javier

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.

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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. Recurrent Neural Networks (RNN) will be presented and analyzed in detail to understand the potential of these state of the art tools for time series processing. 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 anlaytics tools.

Study load

Total learning time: 50h	Hours large group:	10h	20.00%
	Hours small group:	10h	20.00%
	Self study:	30h	60.00%

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Content

Deep Neural Networks

Learning time: 22h

Theory classes: 6h
Laboratory classes: 6h
Self study : 10h

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.

Applications to Speech and Language

Learning time: 28h

Theory classes: 6h
Laboratory classes: 6h
Self study : 16h

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

Qualification system

Lectures: 30%
Lab: 30%
Project: 30%
Communication: 10%
Attendance: -10% of the maximum grade per missed day

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Bibliography

Basic:

Goodfellow, I.; Bengio, Y.; Courville, A. Deep Learning [on line]. 2016 [Consultation: 05/09/2016]. Available on: <http://www.deeplearningbook.org/>.

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>.

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>.

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/>.

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/>.

Others resources:

The details of this course are available and updated online at: https://telecombcn-dl.github.io/2018-idl/