Last update: 06-05-2019

230360 - DLCV - Deep Learning for Computer Vision

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

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

Academic year: 2019

Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)

ECTS credits: 2,5 Teaching languages: English

Teaching staff

Coordinator: Xavier Giró i Nieto

Others: Xavier Giró i Nieto, Elisa Sayrol, Amaia Salvador, Kevin McGuinness and Eva Mohedano

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)
- Short answer test (Test)

Learning objectives of the subject

The aim of this course is to train students in methods of deep learning for computer vision. Convolutional neural networks (convnets) will be presented and analyzed in detail to understand the potential of these state of the art tools in visual pattern recognition. Engineering tips and scalability issues will be addressed to solve tasks such as image classification, object detection or automatic textual captioning. Hands-on sessions will provide development skills so that attendees can solve a selected task in an open scientific benchmark and, if successful, submit their results.

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Study load

Total learning time: 62h 30m	Hours large group:	16h	25.60%
	Hours small group:	4h	6.40%
	Self study:	42h 30m	68.00%

Content

1. Convolutional Neural Networks

Learning time: 18h 30m

Theory classes: 4h
Laboratory classes: 3h
Guided activities: 4h
Self study : 7h 30m

Description:
- Architecture: Forward and recurrent networks.
- Backpropagation
- Layer Visualization.
- Memory and computational requirements.
- Best practices.
- Fine-tunning

2. Applications

Learning time: 44h

Theory classes: 4h
Practical classes: 7h
Laboratory classes: 1h
Guided activities: 15h
Self study : 17h

Description:
- Image retrieval and classification
- Face and object detection/recognition.
- Semantic segmentation
- Saliency prediction
- Image captioning
- Multimodal fusion

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Planning of activities

Laboratory practical exercises	Hours: 4h Laboratory classes: 4h

Description:
- Training of a convnet for character recognition. (1 hour)
- Visualization and ablation of convnet layers. (1 hour)
- Fine-tunning a convnet for transfer learning. (1 hour)
- Local image analysis. (1 hour)

Extended answer test (Final examination)	Hours: 1h Theory classes: 1h

Final project presentations	Hours: 3h Theory classes: 3h

Description:
Oral presentation of a solved Project (30 minutes)

Qualification system

Final examination: 30%
Final project: 30%
Laboratory assessments: 30%
Communication skills: 10%

Bibliography

Basic:

Goodfellow, Ian; Bengio, Y.; Courville, A. Deep Learning [on line]. 2016 [Consultation: 22/02/2016]. Available on: <http://www.deeplearningbook.org/>.

Others resources:

Hyperlink

Fei-Fei Li, Andrej Karpathy, "CS231n: Convolutional Neural Networks for Visual Recognition". Stanford University 2015

http://cs231n.stanford.edu/

Audiovisual material

Slides of the course and the bibliography referred within