

## 230324 - IDLCV - Introduction to 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:     | 2017  |                     |         |
| Degree:            | BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Teaching unit Optional)<br>BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional)<br>BACHELOR'S DEGREE IN ELECTRONIC SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Optional)<br>BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Teaching unit Optional)<br>BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2010). (Teaching unit Optional)<br>BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Teaching unit Optional) |                     |         |
| ECTS credits:      | 2   | 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

#### Transversal:

03 TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

### Teaching methodology

- Lectures
- Application classes
- 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 task using state of the art software frameworks and computational resources.

### Study load

|                          |                    |     |        |
|--------------------------|--------------------|-----|--------|
| Total learning time: 50h | Hours large group: | 16h | 32.00% |
|                          | Hours small group: | 4h  | 8.00%  |
|                          | Self study:        | 30h | 60.00% |

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### Content

|   |   |
|---|---|
| <p>Deep Learning</p>  | <p>Learning time: 14h<br/>Theory classes: 4h<br/>Self study : 10h</p> |
| <p>Description:<br/>Classification, Deep Neural Networks, Convolutional Neural Networks, Backpropagation, Training neural networks, Software frameworks, Computational requirements, Data augmentation, Model visualization, Recurrent Neural Networks, Transfer learning, Unsupervised learning, Optimization, Adversarial Training and Attention models.</p>  |   |
| <p>Computer Vision</p>  | <p>Learning time: 19h<br/>Theory classes: 4h<br/>Self study : 15h</p> |
| <p>Description:<br/>ImageNet. Saliency Prediction. Object detection and recognition. Face detection and recognition. Image retrieval. Semantic segmentation. Vision and language. Video Processing. Medical applications.</p>   |   |
| <p>TensorFlow</p>   | <p>Learning time: 17h<br/>Theory classes: 4h<br/>Self study : 13h</p> |
| <p>Description:<br/>TensorFlow? is an open source software library for numerical computation using data flow graphs. Nodes in the graph represent mathematical operations, while the graph edges represent the multidimensional data arrays (tensors) communicated between them.</p> <p>Related activities:<br/>Practical sessions.<br/>Programming exercises.</p> <p>Specific objectives:<br/>Develop a deep learning project in Python using Tensorflow libraries and tools.<br/>Use TensorBoard to debug the code.</p> |   |

### Qualification system

Daily quizzes: 90%  
Attendance: 10%

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### Bibliography

#### Basic:

Torres, Jordi. First contact with TensorFlow : get started with deep learning programming [on line]. Barcelona: Universitat Politècnica de Catalunya, Barcelona Supercomputing Centre, 2016 [Consultation: 14/07/2017]. Available on: <<http://jorditorres.org/first-contact-with-tensorflow-book/>>. ISBN 978-1-326-56933-4.

Goodfellow, Ian; Bengio, Yoshua; Courville, Aaron. Deep Learning [on line]. 1. MIT Press, 2016 [Consultation: 22/02/2017]. Available on: <<http://www.deeplearningbook.org/>>. ISBN 9780262035613.

#### Others resources:

##### Hyperlink

<https://telecombcn-dl.github.io/2017-dlcv/>

Course site