

230362 - DLSL - Deep Learning for Speech and Language

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:	Giró Nieto, Xavier
Others:	Bonafonte Cavez, Antonio Jesus Rodriguez Fonollosa, Jose Adrian Ruiz Costa-Jussa, Marta Hernando Pericas, Francisco Javier Pascual, Santiago Sayrol Clois, Elisa Giró Nieto, Xavier

Prior skills

It is advisable to have some background in machine learning and signal processing. 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 for speech and language. 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 machine

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translation, speech recognition, speech synthesis or question answering. Hands-on sessions will provide development skills so that attendees can become competent in contemporary data analytics tools.

Study load

Total learning time: 62h 30m	Hours large group:	10h	16.00%
	Hours small group:	10h	16.00%
	Self study:	42h 30m	68.00%

Content

<h4>Advanced Neural Networks</h4>	<p>Learning time: 16h 30m</p> <p>Theory classes: 6h Guided activities: 8h Self study : 2h 30m</p>
<p>Description:</p> <ul style="list-style-type: none"> - Architectures: LSTM, GRU, recursive, Conv-LSTM, dynamic memory networks, TDNN, highway networks... - Training: datasets, back-propagation, optimization, adversarial... - Learning: supervised/unsupervised, continual... - Visualization - Attention models - Embeddings: seq2seq, skip-though vectors... - Ensembles of models <p>Specific objectives:</p> <p>At the end of this course, students will be familiar with the state of the art techniques based on deep learning architectures.</p>	
<h4>Applications to Speech and Language</h4>	<p>Learning time: 50h</p> <p>Theory classes: 6h Guided activities: 10h Self study : 34h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Natural Language Processing - Machine Translation - Speech recognition - Speaker recognition - Speech synthesis - Multimodal: language and vision. - Frameworks and tools: TensorFlow, Keras, Kaldi 	

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Qualification system

Lectures: 30%
Practical: 60%
Attendance: 10%

Bibliography

Basic:

Goodfellow, I.; Bengio, Y.; Courville, A. Deep Learning [on line]. MIT Press, 2017 [Consultation: 05/09/2016]. Available on: <<http://www.deeplearningbook.org/>>. ISBN 0262035618.

Socher, Richard. Deep Learning for Natural Language Processing [on line]. Stanford University, 2016 [Consultation: 05/09/2016]. Available on: <<http://cs224d.stanford.edu/>>.

Complementary:

Luong, T.; Cho, T.; Manning, C. Neural Machine Translation [on line]. ACL Tutorials, 2016 [Consultation: 05/09/2016]. Available on: <<https://sites.google.com/site/acl16nmt/>>.

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

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

Dhruv Batra. Deep Learning for Perception [on line]. Blacksburg, VA, USA: Virginia Tech, 2016 [Consultation: 05/09/2016]. 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/2017-dlsl/>