Course guide
230623 - SLPDL - Speech and Language Processing with Deep Learning

Last modified: 13/06/2025

Unit in charge:	Barcelona School of Telecommunications Engineering
Teaching unit:	739 - TSC - Department of Signal Theory and Communications.

Degree:	MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject). MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2025 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer:	FRANCISCO JAVIER HERNANDO PERICAS
Others:	

PRIOR SKILLS

Calculus and Linear Algebra
Probability and Statistics
Algorithmics and programming
Signal Processing
Large programming experience in Python, Matlab or C++.
Machine Learning
Deep Learning
Large programming experience in Python, Matlab or C++.

If you have not previously taken DLAI, you will not be able to enroll in SLPDL. If you believe that you have the necessary knowledge to take SLPDL, you must contact the SLPDL coordinator so that he or she can assess your background and authorize an exception to the requirement. If the exception to the requirement is authorized, you must make an application that you can request:
Before enrollment, during the enrollment exception application period, so that SLPDL appears in your enrollment potential and you can enroll whenever there are available places.
or
After enrollment, during the enrollment modification period, to include SLPDL in the enrollment, as long as there are still available places
Both enrollment exception applications and enrollment modification applications will be accepted by the MATT Head of Studies provided that the coordinator has communicated the authorization of the exception to the DLAI requirement.

TEACHING METHODOLOGY

Lectures and individual in-class labs

LEARNING OBJECTIVES OF THE SUBJECT

The course is focused on the study of the technologies for the development of advanced applications of spoken and written language. It focuses on new technologies based on deep learning and its application to automatic speech recognition, text to speech, and machine translation.
The final project gives students additional information about a particular topic, and also aims to help boost their own skills in the development of applications or in research.

STUDY LOAD

Type	Hours	Percentage
Hours large group	39,0	31.20
Self study	86,0	68.80

Total learning time: 125 h

CONTENTS

1. Introduction to speech processing

Description:
Introduction to speech technology and applications.
Fundamentals of speech perception and speech production.
Speech spectrum: STFT, Spectrogram.
Features: Cepstrum, MFCC, Pitch.
Techniques: Vector Quantizers, Gaussian Mixture Models.

Full-or-part-time: 6h
Theory classes: 6h

2. Deep Learning

Description:
Introduction to Deep Learning techniques and their application to speech and language processing.

Specific objectives:
Introduction to deep learning, neural nets, learning algorithms, momentum and rmsprop, regularization, word embeddings, recursive neural networks. Applications to Natural Language Processing.

Full-or-part-time: 9h
Theory classes: 9h

3. Automatic speech recognition

Description:
Pattern matching. Dynamic time warping
Hidden Markov models. Isolated word recognition
Large vocabulary continuous ASR: Aacoustic modeling. Language modeling
Deep Llearning for language modelling and automatic apeech recognition.
Toolkits

Full-or-part-time: 10h
Theory classes: 10h

4. Speech synthesis

Description:
Linguistic processing. Prosody modeling
Waveform generation.
Concatenation and statistical methods.
Deep learnign in speech synthesis.

Full-or-part-time: 7h
Theory classes: 7h

5. Machine Translation

Description:
Introduction to Machine Translation. Statistical Machine Translation
Neural Machine Translation
Speech translation.

Full-or-part-time: 7h
Theory classes: 7h

GRADING SYSTEM

Midterm exam: 30%, Final exam: 30%, Assignments: 40%

BIBLIOGRAPHY

Basic:

- Huang, X.; Acero, A.; Hon, H-W. Spoken language processing: a guide to theory, algorithm and system development. Upper Saddle River: Prentice Hall, 2001. ISBN 0130226165.
- Goodfellow, I.; Bengio, Y.; Courville, A. Deep Learning [on line]. Cambridge, Massachusetts: MIT Press, 2016 [Consultation: 22/06/2016]. Available on: http://www.deeplearningbook.org/. ISBN 9780262035613.