

EE-554

**Automatic speech processing**

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Cursus	Sem.	Type
Computer science	MA1, MA3	Opt.
Cybersecurity	MA1, MA3	Opt.
Data Science	MA1, MA3	Opt.
Digital Humanities	MA1, MA3	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.
SC master EPFL	MA1, MA3	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

The goal of this course is to provide the students with the main formalisms, models and algorithms required for the implementation of advanced speech processing applications (involving, among others, speech coding, speech analysis/synthesis, and speech recognition).

**Content**

1. Introduction: Speech processing tasks, language engineering applications.
2. Basic Tools: Analysis and spectral properties of the speech signal, linear prediction algorithms, statistical pattern recognition, dynamic programming.
3. Speech Coding: Human hearing properties, quantization theory, speech coding in the temporal and frequency domains.
4. Speech Synthesis: Morpho-syntactic analysis, phonetic transcription, prosody, speech synthesis models.
5. Automatic Speech Recognition: Temporal pattern matching and Dynamic Time Warping (DTW) algorithms, speech recognition systems based on Hidden Markov Models (HMMs).
6. Speaker recognition and speaker verification: Formalism, hypothesis testing, HMM based speaker verification.
7. Linguistic Engineering: state-of-the-art and typical applications

**Keywords**

speech processing, speech coding, speech analysis/synthesis, automatic speech recognition, speaker identification, text-to-speech

**Learning Prerequisites****Required courses**

Basis in linear algebra, signal processing (FFT), and statistics

**Important concepts to start the course**

Basic knowledge in signal processing, linear algebra, statistics and stochastic processes.

**Learning Outcomes**

By the end of the course, the student must be able to:

- speech signal properties
- Exploit those properties to speech codign, speech synthesis, and speech recognition

### Transversal skills

- Use a work methodology appropriate to the task.
- Access and evaluate appropriate sources of information.
- Use both general and domain specific IT resources and tools

### Teaching methods

Lecture + lab exercises

### Expected student activities

Attending courses and lab exercises. Read additional papers and continue lab exercises at home if necessary. Regularly answer list of questions for feedback.

### Assessment methods

Written exam without notes

### Supervision

Office hours	No
Assistants	Yes
Forum	No

### Resources

#### Bibliography

Fundamentals of Speech Recognition / Rabiner and Juang

#### Ressources en bibliothèque

- [Fundamentals of Speech Recognition / Rabiner and Juang](#)

#### Websites

- <http://lectures.idiap.ch/>

#### Moodle Link

- <https://go.epfl.ch/EE-554>