Study programme(s): Applied Mathematics – Data Science	
Level: master studies	
Course title: Audio, Speech and Language Processing	
Lecturer: Dušan Jakovetić	
Status: elective	
ECTS: 5	
Requirements: Introduction to Digital Signal Processing, Pattern Recognition and Machine Learning, Graphical Models and Probabilistic Inference	

Learning objectives
- Understanding of fundamental concepts in audio, speech and natural language processing and their application in big data analytics

Learning outcomes
- Acquired knowledge of basic algorithms in audio, speech and natural language processing and their application in big data analytics
- Ability to communicate/collaborate with engineers on practical and research problems
- Ability to implement algorithms of audio, speech and natural language processing using appropriate software tools
- Ability to solve real-world problems using the acquired knowledge

Syllabus
Theoretical instruction

Physics of Sound, Auditory perception fundamentals, Speech models and speech synthesis, Compression (MPEG/Audio compression), Speech recognition, Hidden Markov models and finite-state transducers in speech recognition, Statistical Language Models, POS tagging, Syntax and Grammars, Statistical Parsing, Dependency Parsing, Word Sense Disambiguation, Sound mixtures and separation, Music analysis and recognition, Content-based retrieval of large-scale archives.

Practical instruction
Application examples in speech and audio coding, speech recognition and synthesis, language modelling and other relevant domains.

Literature
Selected parts of the following books:
1. Ben Gold and Nelson Morgan: Speech and Audio Signal Processing: Processing and perception of speech and music, Wiley, 2000.
2. Daniel Jurafsky and James H. Martin: Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, 2nd edition, Prentice Hall, 2009.

Weekly teaching load				Other: 0
Lectures: 2	Exercises: 2	Other forms of teaching: 1	Student research: 0	

Teaching methodology
Lectures; revisions of the material; active students' participation in problem solving; knowledge tests – colloquia; homeworks.

Grading (maximum number of points 100)			
Pre-exam obligations	**Points**	**Final exam**	**Points**
Colloquia + homeworks	20 (Colloquia) + 10 (Homeworks)	written exam	70