GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Natural Language Processing, PG_00068332		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2028/2029
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Intelligent Interactive Systems -> Faculty of Electronics Telecommunications and Informatics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jan Daciuk	
	Teachers	dr hab. inż. Jan Daciuk	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	2.0	18.0	50

Subject objectives

The purpose of this subject is to familiarize students with basic techniques used in computational linguistics and to to prepare them for work on development of applications for that domain.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study	Is capable of using acquired knowledge about natural language and speech processing as well as to select appropriate methods and programming tools to develop software for natural language and speech processing applications.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study	Is able to measure effectiveness of applied methods and to measure their precision.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Lecture:

1. Introduction: language, speech and language processing, applications.
2. Text and language data representations, segmentation, normalization.
3. Word and document representations: bag of words (BoW), TF-IDF, embeddings: Word2Vec, GloVe, FastText.
4. N-grams and probabilistic models.
5. Text retrieval.
6. Document classification.
7. Sentiment analysis, topic identification.
8. Document clasterization.
9. Shallow syntactic processing, syntax, parsing.
10. RNN architectures and their applications in sequence analysis (GRU, LSTM).
11. Transformer models (e.g. BERT, GPT) and their application to advanced NLP tasks.
12. Speech: phonetics, phonology, prosody.
13. Autimatic speech recognition (ASR).
14. Speech synthesis (TTS).
15. Intent extraction from speech, dialog systems.

Laboratory:

1. Introduction. (1h)
2. 2. Text data formats, segmentation and normalization.
3. Text retrieval.
4. Parsing, named entity recognition.
5. Text classification, sentiment analysis, topic identification.
6. Speech analysis tools.
7. Speech recognition and synthesis.
8. Dialog system.

Prerequisites and co-requisites

Programming skills (mainly Python).

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	50.0%	50.0%
laboratory	50.0%	50.0%

Recommended reading

Basic literature

1. Daniel Jurafsky, James Martin, Speech and Language Processing. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Third Edition, draft.
2. Marcin Woliński, Automatyczna analiza składnikowa języka polskiego, Wydawnictwa Uniwersytetu Warszawskiego, 2019.
3. Bartosz Ziółko, Mariusz Ziółko, Przetwarzanie mowy, Wydawnictwa AGH, Kraków 2011.

Supplementary literature

1. Alicja Nagórko, Zarys gramatyki polskiej, Wydawnictwo Naukowe PWN, Warszawa, 1996.
2. Ashish Bansal, Advanced Natural Language Processing with TensorFlow 2. Build effective real-world NLP applications using NER, RNNs, seq2seq models, Transformers, and more, Packt, 2021.
3. Rajesh Arumugam, Rajalingappaa Shanmugamani, Hands-On Natural Language Processing with Python. A practical guide to applying deep learning architectures to your NLP applications, Packt, 2018.
4. Zhiyuan Liu, Yankai Lin, Maosong Sun, Representation Learning for Natural Language Processing, Springer, 2020.
5. Piotr Wróblewski, Machine learning i natural language processing w programowaniu, Helion, 2024.
6. Cathy Pearl, Projektowanie głosowych interfejsów użytkownika, Helion, 2021.
7. Sowmya Vajjalla, Bodhisattwa Majumderand, Anuj Gupta, Harshit Surana, Przetwarzanie języka naturalnego w praktyce. Przewodnik po budowie rzeczywistych systemów NLP, Helion, 2023.
8. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Przetwarzanie języka naturalnego z wykorzystaniem transformerów, Helion, 2024.
9. Paul Deitel, Harvey Deitel, Python dla programistów z analizami przypadków wprowadzającymi w tematykę sztucznej inteligencji, Helion, 2020.
10. Lior Gazit and Meysam Ghaffari, Zaawansowane techniki przetwarzania języka naturalnego, Helion, 2025.
11. Marek Wiśniewski, Zarys fonetyki i fonologii współczesnego języka polskiego, Wydawnictwo Uniwersytetu Mikołaja Kopernika, wydanie IV, Toruń 2001.

eResources addresses

Basic

https://web.stanford.edu/~jurafsky/slp3/ - Daniel Jurafsky, James Martin, Speech and Language Processing. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Third Edition, draft.

Example issues/ example questions/ tasks being completed

Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.