

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

**PHD IN INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING**

**PHD IN INFORMATION AND COMMUNICATION TECHNOLOGY FOR HEALTH**

**Module Title: Artificial Intelligence and Natural Language Processing**

**Lecturer: Prof. Francesco Cutugno**

University of Naples "Federico II"

Department of Electrical Engineering and Information Technology

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Associate Professor in Natural Language Processing and Human-Machine Interaction at the Department of Department of Electrical Engineering and Information Technology (DIETI), University of Naples 'Federico II'. He has been president of the Italian Association of Speech Science (AISV) for two mandates and is currently part of the scientific committee of the Italian Association of Computational Linguistics. Since January 2021, he is also director of the interdisciplinary research centre Urban/Eco. His main research interests are: acoustic phonetics; computational linguistics; speech processing; human-machine interaction; mobile App design; technological applications in the Cultural Heritage sector.

**Lecturer: Dr. Maria Di Maro, PhD**

University of Naples "Federico II"

Department of Electrical Engineering and Information Technology

[mariadimaro2@unina.it](mailto:mariadimaro2@unina.it)

Post-doc researcher in computational pragmatics. In 2021, she got her Ph.D. in *Mind, Gender and Language* at the University 'Federico II' with a thesis in Linguistics with a focus on computational models to represent and manage Common Ground in dialogue systems, especially as far as inconsistencies in the Common Ground and the consequent elicitation of clarification requests are concerned. She is currently working on different aspects related to argumentative dialogues, including clarification requests, common sense-based explanations, and argumentation strategies.

**Lecturer: Prof. Antonio Origlia**

University of Naples "Federico II"

Department of Electrical Engineering and Information Technology

[antonio.origlia@unina.it](mailto:antonio.origlia@unina.it)

Assistant Professor at the University of Naples 'Federico II'. After his Ph.D., he concentrated on Human-Computer Interaction topics, mainly focusing on applications for Cultural Heritage. During this work, he also acquired competence in 3D graphics, animation and had significant experience using Unreal Engine. He also acquired competence in designing dialogue systems based on the use of probabilistic graphical models and graph databases. He is the creator of the Unreal Engine plugin "FANTASIA". He currently holds the course "Game Engines Architecture and Interactive Experience" at the Master course in Computer Science at the University of Naples 'Federico II'.

## AD HOC TEACHING MODULE Announcement

### Lecturer: Prof. Vincenzo Norman Vitale

University of Naples "Federico II"

Department of Electrical Engineering and Information Technology

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Assistant Professor at the University of Naples 'Federico II' (October 2023). He got his PhD with a thesis on High-Frequency Time Series data management in Cloud-Edge Continuum. During his Post-Doc period at the Urban/Eco research centre, he focused interpretability of End-to-End Automatic Speech Recognition Systems. His research fields include Deep Learning, Automatic Speech Recognition Systems, Explainable AI, Time-Series Analysis and Cloud-Edge Continuum.

### Dates and Locations (rooms are in building 3 - DIETI, via Claudio 21, Napoli)

Date	Hours	Room	Lecturer
25/09/2023	12:00-14:00	Room 3 <sup>rd</sup> floor	Cutugno
27/09/2023	12:00-14:00	Room 3 <sup>rd</sup> floor	Cutugno
29/09/2023	9:00-11:00	Seminar room	Vitale
2/10/2023	9:00-11:00	Room 3 <sup>rd</sup> floor	Di Maro
4/10/2023	12:00-14:00	Room 3 <sup>rd</sup> floor	Origlia
4/10/2023	15:00-18:00	Room 3 <sup>rd</sup> floor	Cutugno/Origlia

### Content

**Overview:** The course introduces the new vision of Natural Language Processing (NLP) considering the recent revolutions in the field. The advent of Large Language Models like ChatGPT has brought huge changes in the way we all see AI but it has also increased expectations and "noise" in people's minds. At the same time, we observed different reactions from experts in the field, who were forced to specify the pros and cons of this revolution, and from non-experts who suddenly became proficient in their own view. In this perspective, we decided to offer to the doctoral school, and anyone else interested, a series of lectures on the foundations of modern NLP and aspects related to AI.

#### I Lesson - DNN for Natural Language Processing:

- Language Models Ngrams based
- Distributional semantics

## AD HOC TEACHING MODULE Announcement

- Non contextual Embedding Word2Vec
- Autoencoding, Transformers
- Contextual Embeddings

### II Lesson - LLM a review:

- Bert Based Language Models
- Generative Language Models
- ChatGPT and others

### III lesson - ASR and TTS:

- Introduction to modern ASR
- Speech recognition with Transformers: Conformer & Squeezeformer
- Introduction to modern TTS: Tacotron architecture for TTS
- End-to-end ASR: wav2vec, quantization and Hubert

### IV Lesson – Knowledge representation:

- From ontologies to semantic networks and knowledge graphs
- Context and co-text
- Computational pragmatics

### V Lesson - Dialogue systems and conversational agents:

- Processing user utterances
- Graph based reasoning
- Probabilistic graphical model for decision making
- Behaviour synthesis

### VI Lesson - Multimodality:

- Generalities
- Neural fusion techniques
- CLIPS and other methods
- Foundational Models

**ECTS Credits: 3**

## Notes

There will be a final evaluation.

Info: **Prof. Francesco Cutugno (DIETI, UniNA)** – [cutugno@unina.it](mailto:cutugno@unina.it)