TALOS ERA CHAIR IN ARTIFICIAL INTELLIGENCE FOR HUMANITIES AND SOCIAL SCIENCES

ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ
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Computational Linguistics and Corpus Analysis

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Introduction

What this session will cover:

- What is **Computational Linguistics**?
- What is a **Corpus** and why is it useful?
- How can we analyze texts using **AI** and **NLP**?
- **Real-world applications** in Digital Humanities & Social Sciences

What is Computational Linguistics?

- Definition: Computational Linguistics (CL) is **the study of language using computers** (Hausser, 2014).
- It combines **linguistics**, **AI**, and **computer science** to help machines process and understand human language.

Key Questions in CL:

- How can a computer read and understand text?
- How do we teach computers to recognize meaning, grammar, and structure in language?

CL in everyday life

- Examples of CL in everyday life:

Machine Translation (e.g., Google Translate) (Koehn, 2009)

Speech Recognition (e.g., Siri, Alexa) (Yu & Deng, 2016)

Text Analysis & Chatbots (e.g., AI customer support) (Jockers & Thalken, 2020)

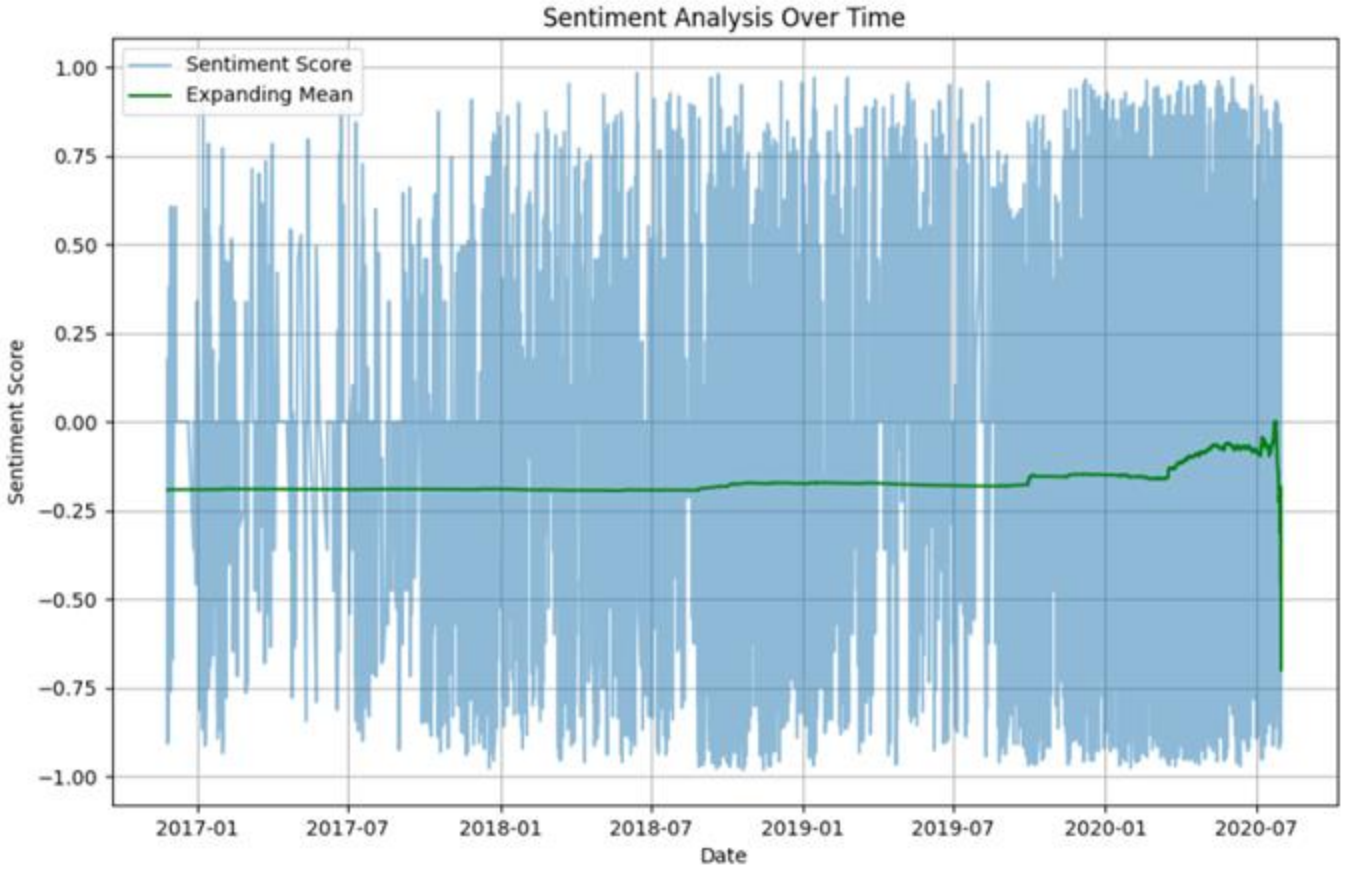
- Why does it matter?

CL helps us analyze large amounts of text automatically, making it essential for Digital Humanities, Social Sciences, and AI applications.

How is CL used in research? - Some examples

- **Topic Modeling** - Discover hidden themes in large text collections (Blei, Ng & Jordan, 2003).
- **Sentiment Analysis** - Detect emotions in texts; analyze public opinion in social media or political speeches (Liu, 2015).
- **Named Entity Recognition** - Identify names of people, places, and organizations in a text (Mohit, 2014).
- **Authorship Attribution** - Determine who wrote a text based on linguistic patterns, e.g., analyzing anonymous or disputed works (Stamatatos, 2009).

Sentiment Analysis



Named Entity Recognition

(...) “ἀναβὰς δὲ εἰς ᾽Ιλιον ἔθυσε τῇ Ἀθηνᾷ καὶ τοῖς ἥρωσιν ἔσπεισε”. → [“᾽Ιλιον”/LOC, “Ἀθηνᾷ”/PER]

Large Language Models

- LLMs are advanced AI models trained on massive amounts of text to understand language and generate human-like language.
- They use deep learning to process text at an unprecedented scale (Achiam et al., 2023).

How do LLMs work?

- Trained on billions of words from books, websites, and articles.
- Predict the most likely next word in a sentence (but in a highly sophisticated way).
- Learn grammar, context, and even subtle nuances of language. (Devlin et al., 2019)

LLMs in Action

- Chatbots & Virtual Assistants
- Text Summarization
- Automatic Translation
- Creative & Academic Writing (eg. Assisting in drafting articles, essays, and stories)

→ LLMs are **transforming how we analyze and generate text**, making them essential for Digital Humanities, historical text analysis, and corpus-based research. However, they also raise **ethical concerns**, such as bias, misinformation, and explainability, which must be critically examined. (Jiao et al., 2024)

The Role of Corpora in Computational Linguistics

A corpus is a large, structured collection of texts that serves as the foundation for training AI models, studying language, and developing NLP applications. (McEnery, 2019)

- **LLMs are trained on huge corpora** containing books, websites, and academic texts.
- Corpora help AI models learn grammar, syntax, and meaning from **real-world language data**.
- Quality of training data = quality of AI output → Biases in corpora can affect AI-generated text.

Corpora for Computational Linguistics, Social Sciences and the Humanities

- Historical & Literary Corpora can be used to study **language evolution** and **authorship attribution**.
- Social Media & News Corpora → Help **analyze public opinion** and sentiment trends.
- Multilingual Corpora → Essential for **machine translation** and **cross-linguistic analysis**.

→ Corpora are **essential for both training AI and conducting research** in linguistics, humanities, and social sciences.

Summary & Conclusion

- CL combines language study and AI to help computers **process, analyze,** and **generate** human language.
- LLMs are **trained on vast amounts of text**; they power applications like chatbots, translation tools, and text analysis.
- Corpora are **large collections of texts** that allow us to study language, meaning, and patterns at scale; Corpus Analysis helps researchers find insights in language and beyond.

→ Computational Linguistics and Corpus Analysis are powerful tools for linguists, historians, social scientists, and AI researchers. They help us understand language on a deeper level, analyze vast amounts of text efficiently, and build AI models that interact with human language.