Natural Language Processing – Methods and Applications

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Outline

Introduction

- What is NLP?

Expectations

- What you can expect.
- What we expect.

Organization

- Examination procedure
- Schedule
- Course Structure
- Advisors

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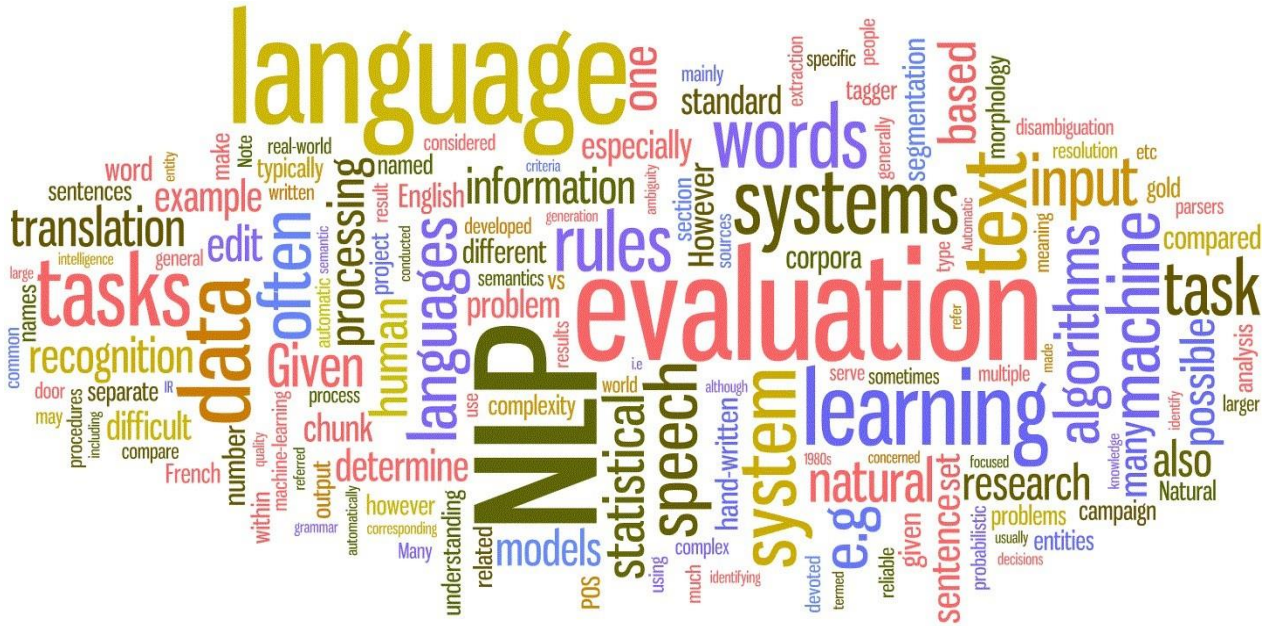
Natural Language Processing (NLP)

We will focus on:

- The core technological components of NLP and their real-world applications
- Texts (with some multimodality but not speech)
- Mostly Methods and Applications
  - With a little bit of theory



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What you can expect: Learning

- Through presentations and demos of others:
  - Overview over different areas and task within Natural Language Processing (and yes, LLMs).
  - Insight into both, general methods and their application.
  - Overview over the current research within the field.

- Through your own work:
  - Deep dive into one topic of your choice.
  - Discuss ideas and get feedback from Advisor who is an expert in your topic.

- Work with scientific literature and peer review process.
  - Learn to write a paper and incorporate your own ideas.
  - Yes, using AI-based tools are allowed.
  - But, we can tell if you do so.

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What you can expect: Topics

Foundations of NLP:
- Word Embeddings: From Bag-of-words to Transformers
- From N-grams to Large Language Models
- Large Language Models: Building Blocks

Techniques in NLP:
- From Binary to Extreme – An Overview of Text Classification Method and their Challenges
- Natural Language Processing and Computer-Human Interaction
- Information Retrieval: (Domain-Specific) Improvement Strategies
- (Generative) Information Extraction (including NER)

Privacy & Security in Natural Language Processing:
- Ethical , Societal, and Legal Aspects of Large Language Models
- Differential Privacy in Natural Language Processing
- Adversarial Attacks on (Large) Language Models and their Mitigations
- Large Language Model Alignment

Large Language Models:
- Domain Adaptations: In-context Learning, RAG and Fine-tuning
- Prompt-Engineering vs. PEFT Approaches
- Text Summarization: Approaches, Challenges and Evaluation
- Question Answering Systems: Challenges and Approaches
- Model Hallucination
- Common-sense & Logical Reasoning with LLMs
- Multimodal LLMs: SOTA Models, Techniques and Benchmarks/Usabillity (and Future Developments)
- Explainability in Natural Language Processing
- Explainable Fact-Checking with LLMs
- Tiny LLMs: Quantization, Pruning and Distillation
- Agent-based Systems using LLM

Conversational AI:
- Task-based, Social Conversational Agents & Dialogue Management (Dialogue State Tracking & Policy)
- Knowledge Graphs for Dialogue State Tracking

Scan for Topic Details

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What we expect.

- Participation (not just attendance)
- Project / Demo (optional) -> 0.3 bonus
- Presentation (30min + 15min discussion)
- Seminar paper (8 pages) + Peer review
- Usage of LaTeX
- You don’t need an extensive knowledge in NLP or ML (but consider your previous knowledge when choosing a topic)

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Examination procedure

- Module Number (Master-Seminar): IN2107
- 5 ECTS (1 ECTS equals to 30h, hence, 5*30h = 150h)
- **Regular attendance** (not more than one missed session)
- **Oral presentation**:
  30 min presentation + 15 min discussion => 45 min
- **Seminar paper**:
  8 pages, LaTeX
- **Peer reviews**:
  Reviews for two other seminar papers
- **Project / Demo (optional)**:
  0.3 bonus grade

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Schedule

Seminar milestones	Dates
Preliminary Meeting	10.02.2025
Send us your CV and Transcript	Until 20.02.2025
Matching System Results	Until 28.02.2025
Send your top 4 Topic Preferences	Until 09.03.2025
Topic Assignment	Until 14.03.2025
14 Weekly sessions (each Friday)	25.04.2025 – 25.07.2025 (10am – 12 pm)
Submission seminar review	xx.08.2025
Submission peer review	xx.08.2025
Submission revised seminar paper	xx.08.2025

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Course Structure

- After being matched to the seminar:
  - Send me your 5 preferred topics (details on this later via email)
  - After 2-3 weeks, you will be assigned a topic and advisor.

- After Topic assignment
  - You would receive Literature List in 2-3 weeks.
  - Get in contact with your advisor to schedule your meetings.

- At least two meetings with your advisor.
  - Topic discussion
  - Presentation feedback
  - Paper feedback

- **If you have questions, please contact your assigned advisor.**

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Seminar Advisors

Anum Afzal
NLP

Research Interests

- Natural Language Generation
- Text Summarization
- Domain Adaptation

Joshua Oehms
NLP

Research Interests

- Scientific Information Retrieval
- NLP for Healthcare Applications
- Low-resource NLP
- Dialog Systems

Juraj Vladika
NLP

Research Interests

- Natural Language Understanding
- Fact-Checking and Model Factuality
- Question Answering

Stephen Meisenbacher
NLP & Privacy

Research Interests

- Privacy-preserving NLP
- Hybrid, Expert-Driven Classification Systems
- Privacy, Data Protection, and Privacy-Enhancing Technologies

Alex Mercier
NLP & Conversational AI

Research Interests

- NLP in Medical Applications
- Dialog Systems
- Information Retrieval
- NLG Evaluation

Mahdi Dhaini
Explainablity in NLP

Research Interests

- Natural Language Explanations
- Feature Attribution Post-hoc Explanations
- Explainable NLP

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Contact and Questions

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Are you Interested in applying?

1) Send your CV and transcript to
Email: anum.afzal@tum.de

Subject: NLP seminar 2025

Deadline: 20.02.2025

2) Apply through the Matching system

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