**** Title ****

Natural language processing for digital health applications (NLH)

**** CFU ****

6 [complementary]

**** Learning outcomes ****

Learning basic and advanced techniques, algorithms, and models used in natural language processing (NLP) and understanding (NLU). Understanding the architectures of typical applications involving natural language, and the libraries for building them. Expertise in the design, implementation, and evaluation of applications involving the analysis, interpretation, and transformation of texts in the context of Digital Health.

**** Syllabus ****

Foundations of Natural Language Processing

- Overview of Natural Language Processing, Information Retrieval, and Machine Learning (ML)
- Linguistic essentials: Words, Lemmas, Morphology, Part of Speech (PoS), Syntax
- Mathematical background for NLP: Probability, Statistics, and Algebra
- Introduction to libraries and tools

NLP Methods and Techniques

- Methods to approach NLP tasks: Rule-based, Statistical, Machine/Deep Learning
- Basic text processing techniques: Regular Expression, Tokenization, Collocations
- Introduction to Machine Learning for NLP: Theory and Practical Tips
- (Large) Language Models and Transformers

Applications and Case Studies in Digital Health

- Information Extraction via classic and ML-based tools: Named Entity Recognition (NER), Term Extraction, Entity linking (and Knowledge graphs), Relation Extraction
- Document Classification and Topic Modelling
- Conversational Agents
- Vision-Language applications
- Generative AI applications

**** Course organization & Assessment****

Each module includes hands-on practical exercises and real-world case studies to reinforce theoretical concepts. The course emphasizes a balance between theory and coding.

- Lectures: 60%
- Laboratory/practice: 30%
- Seminars: 10%

Assessment will consist of some midterm assignments, a software project regarding an application of NLP in the Digital Health context, and an oral exam.

**** Prerequisites ****

- Coding (python), Probability theory, Machine Learning basics, Algorithms, and data structures, problem-solving.