

University of Luleå (Sweden) & University of Ljubljana (Slovenia) research collaboration topics for Erasmus+ exchange students

University of Luleå (Sweden) and University of Ljubljana (Slovenia) have an established on-going research and student exchange collaboration. Within the collaboration, both universities are promoting student exchange between institutions, additionally providing possible topics that students can undertake either for their bachelor/masters theses or research project. The non-exhaustive list of possible topics is given below (if interested, feel free to propose your own).

The supervisors and contact persons of the proposed topics are:

- *prof. Zoran Bosnić, zoran.bosnic@fri.uni-lj.si, University of Ljubljana, Slovenia*
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Topics:

1. Hybrid (unsupervised/supervised) detection of structure in time series: The use case of cardiovascular signals.

In this project it is intended to investigate methods for hybrid learning (that is unsupervised and supervised) of patterns in time series with the goal of automatic diagnostic of cardio-vascular diseases. The student will investigate suitability of a biologically inspired data representation framework known as hyperdimensional computing for fast and energy-efficient word representation.

2. Behavioral biometrics for robust user authentication and identification.

Robust identification of users by their behavioral patterns (writing style, keystroke dynamics, application usage patterns etc) is the key to many security applications. In this thesis the student will compare various techniques for behavioral biometrics and investigate methods for their optimization in time and accuracy. The student will investigate suitability of a biologically inspired data representation framework known as hyperdimensional computing for fast and energy-efficient word representation.

3. Discussion summarization using natural language processing techniques:

Web forums, social media and notice boards are becoming more and more popular places where many users can hold discussions, presenting their views on a given subject. The goal of the thesis is to implement or develop a new summarization algorithm that is able to make an overview of the entire discussion, emphasizing major arguments from users. The student will investigate suitability of a biologically inspired data representation framework known as hyperdimensional computing for fast and energy-efficient word representation.

4. Comparison of different word representation techniques in natural language processing.

Current natural language processing tools use different algorithms for word representation. Some of the most known are: TF-IDF, Word2vec and BERT (Google), Random Indexing. The goal of the thesis will be to choose a few simple already implemented natural language processing tools and observe how the change of word representation algorithm influences the tool's performance. As part of the thesis the student will investigate suitability of a biologically inspired data representation framework known as hyperdimensional computing for fast and energy-efficient word representation.