TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Informatik Institut für Software- und Multimediatechnik, Lehrstuhl für Softwaretechnologie

Task for the preparation of a Bachelor Thesis

Course:	Bachelor Informatik
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Title:	Evaluating the Usability of Large Language Models in Structured Information Extraction from Medical Practice Guidelines

Objectives of work

Problem: Every day, healthcare professionals face the challenge of navigating through extensive patient information and its varying formats. This complexity and time pressure can easily lead to overlooking relevant information to the disadvantage of the patient. With the digitization of all patient records, an adaptive information provision system such as Context-Aware Information System for Medical Environments (CAIS.ME) [1] could enhance the comprehensive analysis of the data provided, thus facilitate more informed decision-making regarding the selection of optimal treatments and improve the early detection of alarming changes in patient health.

Motivation: To provide users with only the most needed and context-relevant information, a knowledge graph concept can be utilized. The Knowledge Graph (KG), prototyped for use in the hospital domain by Tom-Maurice Schreiber in his master thesis [2], calculates relevance scores for each piece of patient information based on the patient's conditions, characteristics, medications, vital values, lab results, allergies, and situation (ICU or routine visit). The most relevant information is then displayed to medical staff according to this score. The current state of the aforementioned KG includes only two diseases. It has been manually constructed based on medical guidelines and other medical literature. As demonstrated in studies [3, 4], Large Language Models (LLMs) can be used for structured medical information retrieval, thus supporting the automation of information extraction.

Goal: This Bachelor's thesis requires the student to investigate the suitability of LLMs for analysing and processing medical practice guidelines. The goal is to identify relationships within medical information that can be used to expand the existing KG with further diseases, while adhering to the graph's underlying meta-model (ontology). Various aspects must be evaluated in order to identify those that improve the accuracy of the generated output. These may include using different pre-trained models (model variants), testing alternative inputs, adjusting generation parameters, and prompt engineering.

Focus of work

1. Define the research problem or gap and outline further research questions that could be addressed
2. Carry out a comprehensive literature review and search for related work to gain insight into the current state of RAG and LLMs for medical information extraction, including their strengths, limitations and recent advancements

3. Research and select LLMs suitable for evaluation, along with methods such as adjustment of prompts, parameters, and dataset representation in order to improve the accuracy of generated outputs
4. Plan the evaluation strategy and find eligible medical data to be used
5. Implement a minimal prototype for the evaluation and perform a comparative evaluation
6. Discuss the results and determine the best solution for extending the KG for the medical domain
7. Suggest future work and areas for improvement

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Supervising professor

Bibliography

[1] EKFZ Digital Health. *Context-Sensitive Data Glasses*. URL: https://digitalhealth.tu-dresden.de/projects/innovation-projects/context-sensitive-data-glasses/.

[2] Tom-Maurice Schreiber. "Context-Adaptive Patient Data Presentation for Information Provision Systems in Healthcare". Master Thesis. Technische Universität Dresden, 2024.

[3] Isabella C. Wiest et al. "Deep sight: enhancing periprocedural adverse event recording in endoscopy by structuring text documentation with privacy-preserving large language models". In: *iGIE* 3.4 (2024), 447–452.e5. ISSN: 2949-7086. DOI: https://doi.org/10.1016/j.igie.2024.08.001. URL: https://www.sciencedirect.com/science/article/pii/S2949708624001067.

[4] Isabella Wiest et al. "Privacy-preserving large language models for structured medical information retrieval". In: *NPJ digital medicine* 7 (Sept. 2024), p. 257. DOI: 10.1038/s41746-024-01233-2.