Quantization-informed Medical Report Generation and Structural Knowledge Construction based on Self-supervised Pre-training and Prompt Paradigm from Multi-modal Medical Data

Project Description: Multi-modal data is the current development trend of intelligent health care because of its information complementarity, and self-supervised pre-training has become an important research direction in artificial intelligence due to their low annotation requirements and outstanding generalized performance. Current knowledge-enhanced pre-training models and prompt learning methods mainly concentrate on the single-modal data, while important quantitative information in medicine is a weakness of current large-scale language models. From multi-modal medical data, we plan to build a multi-modal knowledge graph, use the text modality as the anchor to represent knowledge in the form of multi-modal graphs, and use the prompt paradigm to learn the quantitative information in the captioning and integrate the knowledge graph into multi-modal collaborative pre-training learning to ultimately support the two downstream tasks of quantization-informed medical report generation and structural knowledge construction.

Job Description: We are seeking a highly motivated and skilled Research Fellow specializing in Computer Science, Electronical and Computer Engineering or related field. The ideal candidate should have a background in focusing on deep learning and medical image analysis, with a deep understanding of Self-supervised Learning (SSL), Large Language Models (LLMs), Knowledge Graphs (KGs) and their applications in the medical field. Key responsibilities include:

- Construct multi-modal knowledge graphs of medical data by using the text modality as the anchor and mining the correlations among modalities.
- Propose a new prompt paradigm to learn quantitative information enhanced by multi-modal data so that pre-trained models are capable of understanding and estimation of the quantitative information.
- Generate medical records and construct the corresponding diagnosis knowledge graphs by leveraging quantitation-informed and structural knowledge enhanced self-supervised pre-training models.

Throughout the experience as a Focused Research Extended Experience (FREE) research fellow, you will be able to cultivate the relevant research and practical skills in a focused and extensive manner such that enhancing your chances for contributing to the development and submission of research papers in reputable journals, advancing graduate studies or getting a well-paid industrial job.

This position commences immediately, with a negotiable start date no later than October 2024. The term of employment spans two years, and the contract is structured for annual renewal.

Qualifications:

- ➢ Master's or bachelor's degree in computer science, Electrical and Computer Engineering, or a related field with a focus on deep learning and medical image analysis.
- ➢ Proficiency in coding, especially Python, and using a deep learning framework (PyTorch/TensorFlow/Keras).
- ➢ Good English reading and writing skills.