Open Thesis / Project
Integration of Spatiotemporal Data into LLMs

Embedded Learning and Sensing Systems Group

Motivation

With the rise of Large Language Models (LLMs) across various domains, there is a growing need to incorporate complex spatiotemporal data, such as maps (e.g., OpenStreetMap), for tasks that involve navigation, orientation, and practical decision-making. The challenge lies in efficiently encoding and passing this spatiotemporal information to LLMs to enhance their ability to answer practical questions while maintaining computational efficiency. The goal of this project/thesis is to investigate and develop methods for the efficient integration of spatiotemporal data into LLMs (e.g., Llama, Gemini or ChatGPT) for in-context learning and inference. This includes exploring data encoding strategies, modifying model architectures, and evaluating their effectiveness in practical scenarios such as navigation and orientation. A closely related paper on graph integration: https://arxiv.org/pdf/2310.04560.

Interested? Please contact us for more details!

Target Group

Students in ICE, Computer Science or Software Engineering.

Thesis Type

Master Project / Master Thesis.

Image source: DALL-E

Goals and Tasks

- Conduct a thorough literature review on spatiotemporal data representations and in-context learning in LLMs.
- Develop methods to efficiently encode and integrate map data (e.g., OpenStreetMap) into LLMs for in-context learning.
- Evaluate the performance of these methods in practical tasks, such as navigation and orientation.
- Compare the computational efficiency and accuracy of different integration approaches.
- Present the results of your work and summarize the outcomes in a written report.

Requirements:

- Strong understanding of neural networks and LLMs.
- Proficiency in programming languages such as Python.
- Familiarity with deep learning frameworks like PyTorch or TensorFlow.

Used Tools & Equipment

- Access to computation clusters and map data resources like OpenStreetMap.
- Use of deep learning frameworks (e.g., PyTorch, TensorFlow) for model development and testing.

Contact Persons

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