Universität Zürich[UZH]

UNIVERSITY OF ZURICH
DEPARTMENT OF COMPUTATIONAL LINGUISTICS
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Call for Master's Thesis (6 months)

Project Title

Analyzing In-context Language Learning in Long-context Large Language Models

Supervisors

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Abstract

This project investigates in-context language learning, a use case of in-context learning in long-context large language models (LLMs). Specifically, LLMs will learn a new language by input a whole grammar book with grammar explanations and few parallel examples as the context prompts and enable it learn how to translate from this new language to English. A detailed analysis about key factors affecting the new language learning efficiency and effectiveness will be conducted, and exploration about better in-context language learning method will be investigated.

Problem Statement and Research Goals

In this project, student will study *in-context language learning*, the problem of learning a new natural language only in the context of a large language models (LLMs). Student will explore in-context language learning using long-context LLMs such as Qwen-2.5-7B-1M [1] and Gemini-1.5-Flash [2], and analyze key factors affecting the performance of learning a new language from a grammar book and few parallel examples. Try to design a novel method to improve the performance of downstream tasks when performing in-context language learning.

Project Objectives

The minimum required outcome should be a comprehensive analysis of factors of in-context language learning in different languages and models with detailed results comparison. Additional requirement is proposing a novel method for enhancing in-context language learning performance. The outcome could potentially lead to a publication at top tier NLP or ML conferences, such as ACL or ICLR.

Related Works

Tanzer et al. [3] introduces the task of Machine Translation from One Book (MTOB), a benchmark for learning to translate between English and Kalamang. It asks a model to learn a language from a single human-readable book of grammar explanations, rather than a large mined corpus of in-domain data. Gemini [2] using its extremely long context window is able to use in-context learning on the Kalamang resources to improve substantially on the English - Kalamang translation task. More recently, Aycock et al. [4] find almost all improvement stems from the parallel examples

rather than grammar explanation. All previous works mainly focusing on one language directions and mainly use Gemini 1.5, this project will investigate more languages and models in a more general setting.

Qualifications

We welcome Master's students to apply for this thesis opportunity if you

- are passionate about cutting-edge NLP research, especially theories and applications of large language models;
- enrolled at a Swiss university (UZH, ETH, EPFL, etc.) with a STEM major (computer science, computational linguistics, electrical engineering, mathematics, physics, etc.);
- have hands-on coding experience with Python;
- gained basic concepts of language modeling and in-context learning;
- are familiar with common deep learning frameworks such as PyTorch and vLLM.

We are happy to assist you in applying student grants if any.

Application

To apply for this Master's thesis, please send both your CV and your recent academic transcript to `hanxu.hu@uzh.ch` (with `yingqiang.gao@uzh.ch` in cc).

Deadline: February 28 2025 23:59, anywhere on earth.

Start date: April 1 2025 or upon agreement.

We will later email you about further organizational steps if we see you as a match.

References

[1] An Yang, Bowen Yu, Chengyuan Li, Dayiheng Liu, Fei Huang, Haoyan Huang, Jiandong Jiang, Jianhong Tu, Jianwei Zhang, Jingren Zhou, Junyang Lin, Kai Dang, Kexin Yang, Le Yu, Mei Li, Minmin Sun, Qin Zhu, Rui Men, Tao He, Weijia Xu, Wenbiao Yin, Wenyuan Yu, Xiafei Qiu, Xingzhang Ren, Xinlong Yang, Yong Li, Zhiying Xu, and Zipeng Zhang. Qwen2.5-1M Technical Report, 2025. URL https://arxiv.org/abs/2501.15383.

[2] Gemini. Gemini 1.5: Unlocking Multimodal Understanding Across Millions of Tokens of Context, 2024. URL https://arxiv.org/abs/2403.05530.

[3] Garrett Tanzer, Mirac Suzgun, Eline Visser, Dan Jurafsky, and Luke Melas-Kyriazi. A Benchmark for Learning to Translate a New Language from One Grammar Book. In *The Twelfth International Conference on Learning Representations*, 2024. URL https://openreview.net/forum?id=tbVWug9f2h.

[4] Seth Aycock, David Stap, Di Wu, Christof Monz, and Khalil Sima'an. Can LLMs Really Learn to Translate a Low-Resource Language from One Grammar Book? In *The Thirteenth International Conference on Learning Representations*, 2025. URL https://openreview.net/forum?id=aMBSY2ebPw.