BACHELOR‘S THESIS ASSIGNMENT

I. Personal and study details

Student's name: **Klouda Vojtěch** Personal ID number: **507654**

Faculty / Institute: **Faculty of Electrical Engineering**

Department / Institute: **Department of Control Engineering**

Study program: **Cybernetics and Robotics**

II. Bachelor’s thesis details

Bachelor’s thesis title in English:

Meta-prompts for LLM Prompt Optimization

Bachelor’s thesis title in Czech:

Meta-prompty pro optimalizaci promptu velkého jazykového modelu

Name and workplace of bachelor’s thesis supervisor:

Ing. Jan Drchal, Ph.D. Artificial Intelligence Center FEE

Name and workplace of second bachelor’s thesis supervisor or consultant:

Date of bachelor’s thesis assignment: **24.01.2025** Deadline for bachelor thesis submission: **23.05.2025**

Assignment valid until: **do konce letního semestru 2025/2026**

doc. Ing. Zdeněk Hurák, Ph.D.
Head of department’s signature

prof. Mgr. Petr Páta, Ph.D.
Vice-dean´s signature on behalf of the Dean

III. Assignment receipt

The student acknowledges that the bachelor’s thesis is an individual work.
The student must produce his thesis without the assistance of others, with the exception of provided consultations.
Within the bachelor’s thesis, the author must state the names of consultants and include a list of references.

Date of assignment receipt

Student’s signature

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Guidelines:

This thesis explores the design of so-called meta-prompts, which are important modules of prompt optimization methods for LLMs. Focus on different approaches to 1) generate initial solutions (prompts) and 2) improve existing solutions in a supervised learning setting of prompt optimization (given a small training dataset and additional test data.)
1) Review current methods for prompt optimization and meta-prompt design.
2) Pay special attention to black-box optimization techniques and prompting approaches such as Chain of Thought, Tree of Thought, ReAct, or Reflexion.
3) Design and implement several meta-prompting approaches to generate initial and improve existing prompts.
3) Implement a basic black-box optimization method (e.g., a hill-climber) to the meta-prompting operators.
4) Identify existing datasets or create new ones, focusing on tasks with complex input-output transformation relationships.
5) Design an evaluation methodology and conduct experiments to assess the performance of the proposed method.

Bibliography / sources:

[1] Guo, Qingyan, et al. "Connecting large language models with evolutionary algorithms yields powerful prompt optimizers." arXiv preprint arXiv:2309.08532 (2023). [2] Cui, Wendi, et al. "PhaseEvo: Towards Unified Long-Context Prompt Optimization for Large Language Models." First Workshop on Long-Context Foundation Models@ ICML 2024.
[2] de Wynter, Adrian, et al. "On Meta-Prompting." arXiv preprint arXiv:2312.06562 (2023).
[3] Hou, Yutai, et al. "MetaPrompting: Learning to learn better prompts." arXiv preprint arXiv:2209.11486 (2022).
[4] Pryzant, Reid, et al. "Automatic Prompt Optimization with “Gradient Descent” and Beam Search." Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing. 2023.
[5] Soylu, Dilara, Christopher Potts, and Omar Khattab. "Fine-Tuning and Prompt Optimization: Two Great Steps that Work Better Together." Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing. 2024.