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Proposal for Master 2 or PFE Internship

Topic	: LLM assisted Design of Complex Software Systems
Location	: IRIT[1]/ENSEEIHT[2]/Toulouse Institut National Polytechnique[3]
Starting date	: February/march 2024
Duration	: 4 to 6 months
Supervisors	: Meriem OUEDERNI and Lotfi CHAARI
Funding	: GERS Project (ETI2025)
Keywords	: AI4SE, AI4MBSE, Software Engineering, LLMs, Generative AI, Prompt Engineering

1- Context

Artificial intelligence and software engineering are different branches of computer science that can significantly contribute to each other. The rapid growth of Generative AI and particularly large language models (LLMs) enabled remarkable achievements for several code tasks based on text-prompting. For instance, it is possible to transform, add comments, think on, and summarize code. Most software experts agree that LLMs, such as those used by Copilot and ChatGPT, are expected to revolutionize the way in which software is developed. Many existing work are currently advocating the potential advantages generative AI models for writing code. However, the analysis of the current state of LLMs with respect to software modeling has received little attention. In our previous work, we suggested a new method for AI-guided software modeling. Promising results have been obtained with valuable insights for software engineering. Current LLMs are still not suitable to efficiently apply generative AI models for software modeling. Our findings show that, in contrast to code generation, the performance of the current versions of LLMs still suffer from several open issues such as insufficient training on specific languages, explicability, reliability, hallucination, scalability, resources consumption, and lack of real-time information. Those challenges once dealt with, LLMs would be insightful assistant for Software engineers. The results of this work would highly impact MBSE.

2- Internship goal :

The current internship deals with generative AI for Model Based Software Engineering (AI4MBSE). The hired student will proceed as follows. He/she will:

- Thoroughly study the aforementioned issues in order to state how LLMs can be invaluable to assist software modeling.

1 https://www.irit.fr
2 https://www.enseeiht.fr
3 https://www.inp-toulouse.fr

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- Focuses on LLM prompting for real-world cases coming from industrial partners who are expert in embedded and railway systems.
- Develop a POC on a new prompting method.
- Validate the conducted results using existing LLMs.

3- Required Skills

- Good background on Software Engineering, formal methods, MBSE, and AI
- Good English level

4- **Required Profil**

Master 2 Computer Science or equivalent (engineering school).

5- Application Process

Interested candidates should submit the following documents to meriem.ouederni@irit.fr:

• Detailed CV

• Cover letter explaining your motivation and relevant experience

• Academic transcripts

• References

4- Bibliographic References :

- MDE in the Era of Generative AI. A. ALAOUI MDAGHRI, M. Ouederni, and L. Chaari. Accepted to be published in VECOS'24 proceedings.

- Model-Driven Engineering. Douglas C. Schmidt. Computer Society-39.2 (2006) 25.
- Model-driven software engineering in practice. M. Brambilla, J. Cabot, M. Wimmer. Morgan and Claypool Publishers. 2017.