TSE - Revised Project Proposal

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This is an entirely new proposal.

AI-Driven Unit Test Generation

1 Introduction

In recent years, pre-trained models have shown remarkable success in various program understanding and generation tasks. This opens the door for unit test generation. For software engineers to ensure code correctness and maintainability, unit tests are a must. Today, many IDEs provide features beyond editing such as bug fixing and code analysis. Soon, they will incorporate unit test generation as a regular feature; in fact, some already have [1]. On the other hand, Stack Overflow's 2022 Developer Survey results still indicate a large demand for Vim (23.34%), Nano (9.26%), and Emacs (4.51%) [2]. Since many developers prefer these built-in editors over IDEs, I propose developing a CLI tool catering to the needs of this target audience. My lightweight solution will require minimal installation, allowing for easy portability and compatibility with multiple systems.

2 Dataset

I will use the Methods2Test dataset available at `https://github.com/microsoft/methods2test`, introduced in [3]. It maps unit tests to specific classes and methods that they are testing. Since the dataset is in Java, my project's scope will be limited to only this programming language.

3 Methodology

I will train a model or fine-tune an existing one such as CodeBERT, CodeGPT, or GPT-4 over the dataset. My research questions will be focused around how model architecture and hyperparameters affect performance. I will create a CLI tool that a developer can run in a code repository and have unit tests generated for it. Depending on the model choice, unit test generation can happen on the developer's computer or may require a backend hosted on the cloud. In the latter case, I will create a backend service hosted on AWS that runs the model and returns results to the CLI tool.

4 Evaluation

I will use BLEU score to evaluate model performance and select the best one. For the CLI tool, I plan to get a small group of participants studying Computer Science or related fields to use it and give feedback. This group will be selected from people who have worked or interned at technology companies and are familiar with writing & reviewing unit tests.

References

[1] Mikejo5000, et al. "Generate Unit Tests for Your Code with IntelliTest - Visual Studio (Windows)." *Generate Unit Tests for Your Code with IntelliTest - Visual Studio (Windows) — Microsoft Learn*, https://learn.microsoft.com/en-us/visualstudio/test/generate-unit-tests-for-your-code-with-intellitest?view=vs-2022.

[2] "Stack Overflow Developer Survey 2022." *Stack Overflow*, https://survey.stackoverflow.co/2022/#integrated-development-environment.

[3] Tufano, Michele, et al. "Methods2Test: A dataset of focal methods mapped to test cases." *Proceedings of the 19th International Conference on Mining Software Repositories.* 2022, https://dl.acm.org/doi/abs/10.1145/3524842.3528009.