

Code Needs Comments: Enhancing Code LLMs with Comment Augmentation

Demin Song¹, Honglin Guo^{1,2}, Yunhua Zhou¹, Shuhao Xing^{1,2}

Yudong Wang¹, Zifan Song¹, Wenwei Zhang¹

Qipeng Guo¹, Hang Yan^{1,2}, Xipeng Qiu², Dahua Lin^{1,2}

¹Shanghai AI Laboratory, ²School of Computer Science, Fudan University

³The Chinese University of Hong Kong

{songdemin,zhouyunhua,xingshuhao,dispatch,wangyudong}@pjlab.org.cn

{songzifan,zhangwenwei,guoqipeng,yanhang,lindahua}@pjlab.org.cn

{hlguo20,xpqi}@fudan.edu.cn

Abstract

The programming skill is one crucial ability for Large Language Models (LLMs), necessitating a deep understanding of programming languages (PLs) and their correlation with natural languages (NLs). We examine the impact of pre-training data on code-focused LLMs’ performance by assessing the comment density as a measure of PL-NL alignment. Given the scarcity of code-comment aligned data in pre-training corpora, we introduce a novel data augmentation method that generates comments for existing code, coupled with a data filtering strategy that filters out code data poorly correlated with natural language. We conducted experiments on three code-focused LLMs and observed consistent improvements in performance on two widely-used programming skill benchmarks. Notably, the model trained on the augmented data outperformed both the model used for generating comments and the model further trained on the data without augmentation.

1 Introduction

The development of Large Language Models (LLMs) has made remarkable strides across various domains, including the field of code understanding and generation. Works such as CodeGen (Nijkamp

Language	#Chars of Comment	#Chars	Comment Density
C#	5.48	3058	0.1764
C++	6.68	3808	0.1753
Go	3.08	1968	0.1553
Java	1.28	6688	0.1917
JavaScript	6.38	4698	0.1352
PHP	5.18	4238	0.1207
Python	9.68	4418	0.2187
Ruby	0.98	5.88	0.1821
Rust	1.18	6.48	0.1641
TypeScript	2.48	2018	0.1207
Average	5.08	3288	0.1678

Table 1: Comment density across ten mainstream programming languages in StarCoder (Li et al., 2023a). #Chars of Comment indicates the number of non-white characters of the code comment. #Chars is the total number of non-white characters. In fact, high quality repositories even have comment density exceeding 40%, such as the case of `mini redis`¹. This suggests that the existing code dataset indeed contains too few comments.

2023a), which is currently one of the most popular code LLMs, also mentioned that 8% of their sample data was sourced from natural language datasets related to code. In fact, comments are the natural language components that are inherently related to code. Guo et al. (2022) had conducted ablation experiments to demonstrate that training models on code data with comments leads to improved ability. Moreover, the textbook and exercise data proposed by Gunasekar et al. (2023a), which is considered a

Anthology With Comments

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