

Large Language Models for Automated Code Generation and Analysis

Vishal Soni, Research Scholer, Department of Computer Science, J.R.N. Rajasthan Vidyapeeth University, Udaipur, Rajasthan

Abstract

Large Language Models (LLMs) have emerged as a promising technology for automating various software development activities, including code generation, code completion, debugging, documentation, and program analysis. By learning patterns from large-scale programming and natural language datasets, LLMs can generate code based on natural-language requirements and assist developers in solving programming tasks more efficiently. This paper investigates the application of LLMs for automated code generation and analysis, with a focus on their effectiveness, limitations, and potential impact on software development. The study examines how LLM-based systems can transform natural-language descriptions into executable code and analyze existing programs to identify potential errors, vulnerabilities, and quality issues. It also considers important evaluation factors such as functional correctness, code quality, security, computational efficiency, and maintainability. Although LLMs can significantly reduce development effort and support programmers with repetitive tasks, generated code may contain syntactic errors, logical flaws, insecure implementations, or dependencies on incorrect assumptions. Therefore, human verification and appropriate testing remain essential for reliable software development. The paper further discusses challenges related to hallucination, context limitations, training-data bias, and the handling of complex software requirements. The findings highlight the potential of LLMs as intelligent programming assistants while emphasizing the need for robust validation, testing, and responsible integration into software engineering workflows.

Keywords: Large Language Models, Code Generation, Code Analysis, Artificial Intelligence, Software Engineering, Program Synthesis, Code Completion, Automated Programming, Code Quality, Secure Coding.