

USING ARTIFICIAL INTELLIGENCE IN SOFTWARE DEVELOPMENT

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Annotation: Artificial intelligence (AI) technologies are increasingly being utilized in the software development process, bringing improvements in efficiency, speed, and innovative solutions to this field. This article analyzes modern methods and the significance of using AI tools at various stages of software development (design, coding, testing, deployment, and maintenance). Key aspects such as AI-based automation, error detection, code generation, and user interface optimization are examined. Additionally, the challenges encountered in AI-driven software development, security concerns, and future development prospects are discussed.

Аннотация: Технологии искусственного интеллекта (ИИ) находят все более широкое применение в процессе разработки программного обеспечения, способствуя повышению эффективности, скорости работы и совершенствованию инновационных решений в этой области. В данной статье анализируются современные методы и значимость использования инструментов ИИ на различных этапах разработки ПО (проектирование, кодирование, тестирование, развертывание и обновление). Рассматриваются такие аспекты, как автоматизация на основе ИИ, обнаружение ошибок, генерация кода, оптимизация пользовательского интерфейса и другие. Кроме того, обсуждаются возникающие трудности, вопросы безопасности и перспективы дальнейшего развития в области разработки ПО с применением искусственного интеллекта.

Keywords: artificial intelligence, software development, automated coding, AI tools, machine learning, software engineering.

Ключевые слова: искусственный интеллект, разработка программного обеспечения, автоматизированное программирование, инструменты ИИ, машинное обучение, программная инженерия.

INTRODUCTION:

With the development of modern technologies, the importance of artificial intelligence (AI) technologies in the field of software development is increasing. AI-based solutions allow not only to automate the process of developing software products, but also to improve its quality, minimize errors, and reduce the duration of project implementation. In recent years, the development of AI technologies, especially the processing of large amounts of data, the improvement of natural language understanding (NLP) and machine learning (ML) algorithms, has opened up new opportunities in software engineering. AI tools help programmers effectively perform complex tasks such as code generation, test automation, detection of security vulnerabilities, and even user interface optimization. The study provides analytical information on modern AI tools (for example, GitHub Copilot, ChatGPT, IBM Watson, etc.) and their role in the software development process. In addition, the impact of AI-based automation on the workflow of software engineers, ethical issues, and security aspects are also studied.

METHODS:

In this study, the following scientific methods were used to assess the effectiveness of using artificial intelligence technologies in the software development process: Systematic literature review method: Analysis of more than 50 scientific articles, conference proceedings, and technical documents published in 2018-2023 Using reliable scientific databases such as IEEE Xplore, SpringerLink, ACM Digital Library Evaluation of selected sources according to the following criteria: Scope of application of AI technologies Application stage in the software life cycle Results obtained and performance indicators Experimental research method: Experience working with AI assistants such as GitHub Copilot, Tabnine, Amazon CodeWhisperer Comparing the effectiveness of AI tools in similar projects (web application, mobile application, database system) Measuring the following metrics. Code generation speed (lines per hour) Error detection percentage Processing time Software performance indicators Qualitative analysis methods: In-depth interviews with 15 experienced software engineers Identifying the advantages and disadvantages of AI tools through focus group discussions Systematizing expert opinions using the CAB (Content Analysis) method Statistical analysis methods: Analyzing the obtained experimental data in SPSS 26 Determining the statistical significance of the results using ANOVA and t-test methods Studying the relationship between the effectiveness of AI tools and programmer experience through correlation analysis.

RESULTS:

Code generation efficiency: In projects where AI assistants were used, the code generation speed increased by an average of 35-40% The time to write standard functions was reduced by 65% The highest efficiency was recorded in Python (42%) and JavaScript (38%) The efficiency of AI assistants in complex algorithms was around 15-20% Error detection and correction: AI systems integrated with static analysis tools achieved an error detection rate of 78% Accuracy in finding security vulnerabilities reached 82% The total number of errors decreased by 40% in projects where AI was used. Efficiency in the testing process: Automated test script generation saved 55% of time Unit test coverage increased from 68% to 89% Time spent on regression tests decreased by 60% Developer efficiency: Experienced developers (5+ years of experience) used AI tools 28% more effectively Learning curve for beginners decreased by 40% Project delivery time decreased by 30-35% on average Problems and limitations: 22% of AI-generated code required human review Efficiency was 15% lower on tasks requiring specialized domain knowledge Work speed decreased by 25% on large projects. Statistical analysis results: ANOVA test results ($F=6.72$, $p<0.05$) showed that the differences between different AI tools were statistically significant. Correlation analysis ($r=0.68$) showed a moderately strong correlation between programmer experience and the effectiveness of using AI tools. t-test results ($t=4.31$, $p<0.01$) confirmed the significant difference between the results of projects with and without AI. Analytical comparison: Positive aspects: Shortening the development cycle. Reducing errors. The ability for programmers to devote more time to creative work. Negative aspects: Ineffective in areas requiring specialized knowledge.

DISCUSSION:

Analysis of research results The empirical data obtained during the study showed the following main trends: Acceleration of the development process: 35-40% time savings were observed in routine code writing processes The most significant effect was noted in the early stages of the software life cycle (design and prototyping) Automation of testing processes resulted in 55% time savings Improvement in quality indicators: The number of errors in the

first versions of code generated using AI was 40% lower than in traditional methods The level of compliance with code standards increased from 68% to 89% The accuracy of detecting security vulnerabilities reached 82% The scientific significance of the results The research results confirmed the following scientific aspects: The limits of the effectiveness of AI tools: It was found that the effectiveness of AI solutions is 15-20% lower in tasks requiring complex logical structures It was shown that the participation of a human expert is still indispensable in areas where specialized domain knowledge is required The optimal model of human-AI cooperation: Experienced programmers AI used tools 28% more efficiently. The chain "AI-suggested solution - expert verification - improvement" can be recommended as an optimal work model. Practical significance The results of the study can serve as the basis for the following practical applications: In project management: Taking into account 30-35% time savings through the use of AI tools in the planning process. Allocating additional resources for verification of generated code for critical systems. In the educational process: Introducing special modules on the use of AI tools in software engineering programs. Taking advantage of the opportunity to reduce the learning difficulty for beginners by 40%. Limitations and future research directions The following limitations were identified during the research process: Methodological limitations: The study was limited to only 3 types of projects (web, mobile, database). The number of AI tools used was limited (3 main platforms). Suggestions for future research: Conducting research on creating domain-specific AI models. Studying the effectiveness of AI tools in large-scale corporate projects. Comparing the long-term technical feasibility of AI generation and human-side code.

CONCLUSION:

The results of the study show that artificial intelligence technologies provide significant optimization opportunities in the software development process. However, at the current stage, they cannot completely replace a human specialist. The most effective model for using AI tools is the optimal combination of the creative abilities of a human specialist and the fast processing capabilities of AI. In the future, with the further development of AI technologies and the emergence of industry-specific models, their role in the software development process is expected to increase significantly. At the same time, the importance of human control and expert decisions will remain in the foreseeable future.

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