Reinforcement Learning-Driven Software Defect Classification Using PPO and Static Code Metrics

Kadiyala Vaishnavi
Department of Computer Science and Engineering, SRM University, Andhra Pradesh, Amaravati, India

Nallapaneni Mouni Sri
Department of Computer Science and Engineering, SRM University, Andhra Pradesh, Amaravati, India

Yadla Srija
Department of Computer Science and Engineering, SRM University, Andhra Pradesh, Amaravati, India

Gudipati Sri Hasitha
Department of Computer Science and Engineering, SRM University, Andhra Pradesh, Amaravati, India

Abstract:

The analysis of these defects can be described as Software defect prediction play a critical role in improving software reliability, reducing maintenance costs and that of conducting early fault detection during software development. Inkpuneet kumar Chatterjee Ganesh Kiran Refugees et cetera Software Engineering - A radical framework for automated software defect prediction for robot assets are static code analysis, feature engineering and machine learning in an unified framework. The proposed way to extract quantitative software metrics directly from source code lines of code, cyclomatic complexity, and Halstead metrics to build representation of a comprehensive feature of program structure and behavior. These features are normalized with the help of preprocessing pipeline and fed in a supervised learning model based on the gradient boosting techniques.

To improve the predictive performance, the model hyperparameters are optimized following reinforcement learning approach based on Proximal Policy Optimization (PPO) to enable adaptive and efficient exploration of the model hyperparameters. The system provides for multiple types of inputs (direct code input and structured metric entry) and achieving the flexibility of the evaluation for various use cases of the system. Test under defect and predict prediction in defetct probability as well as confindence level and probability results, combination of classification with interpretability Also there is tracking of history of prediction in the system being able to monitor and analyze system continuously.

The combination of automatic metric extraction with an optimized model of an machine learning algorithm allows a better accuracy and robustness in the detection of the defect prone components in the software applications. The proposed framework does not only eliminate the time-consuming effort in calculating the features but also closes the gap between software engineering practices and intelligent predictive analytics rendering it suitable to be used in real-world deployment in software quality assurance processes.

Keywords:

software defect prediction, machine learning, XGBoost, Proximal Policy Optimization, static code analysis.