POLITECHNIKA RZESZOWSKA im. I. Łukasiewicza   Rzeszow, 2022

Discipline of Information and Communication Technology

SUMMARY OF THE DOCTORAL DISSERTATION

PREDICTION OF DEFECTS IN THE SOURCE CODE USING THE FUZZY INFERENCE SYSTEM

Author: Mgr inż. Michał Madera

Supervisor: Prof. dr hab. inż. Jacek Kluska

Assistant Supervisor: Dr hab. inż. Maciej Kusy

This dissertation is related to source code error prediction using artificial intelligence methods, especially models based on the fuzzy inference system. The work aims to develop a classifier capable of detecting defects in the source code, meeting the requirements defined in the thesis. The thesis talks about the possibility of designing a classifier that can generate clear rules, provides control over rules complexity, meeting the qualitative criteria in terms of classification accuracy considering cost accounting, and can be used in practice. The work presents theoretical foundations, the operation principle, and the decision-making system interpretation based on fuzzy rules and gene expression programming. Such a classifier was constructed and tested with a series of experiments using 20 different classification algorithms on 57 defect datasets. Formulated and proved is the theorem of the cost of defect classification in the context of the software development process. Conclusions were developed using classical descriptive statistics, Scott-Knott tests, and the Wilcoxon test for paired observations. The interpretability of the created models was compared in terms of the complexity and clarity of the obtained rules. It has been proven that it is possible to develop an effective algorithm based on the classic Takagi-Sugeno rule-based system that meets all the requirements of the thesis. The developed classifier, used to predict defects, provides clear and simple rules and is one of the best among contemporary shallow classifiers in the sense of generally recognized quality indicators. The algorithm has the potential to be used in production environments.