

# Software Defect Prediction: A Multi-Criteria Decision-Making Approach

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## Abstract

*Failure of software systems as a result of software testing is very much rampant as modern software systems are large and complex. Software testing which is an integral part of the software development life cycle (SDLC), consumes both human and capital resources. As such, software defect prediction (SDP) mechanisms are deployed to strengthen the software testing phase in SDLC by predicting defect prone modules or components in software systems. Machine learning models are used for developing the SDP models with great successes achieved. Moreover, some studies have highlighted that a combination of machine learning models as a form of an ensemble is better than single SDP models in terms of prediction accuracy. However, the efficiency of machine learning models can change with diverse predictive evaluation metrics. Thus, more studies are needed to establish the effectiveness of ensemble SDP models over single SDP models. This study proposes the deployment of Multi-Criteria Decision Method (MCDM) techniques to rank machine learning models. Analytic Network Process (ANP) and Preference Ranking Organization Method for Enrichment Evaluation (PROMETHEE) which are types of MCDM techniques are deployed on 9 machine learning models with 11 performance evaluation metrics and 11 software defects datasets. The experimental results showed that ensemble SDP models are best appropriate SDP models as Boosted SMO and Boosted PART ranked highest for each of the MCDM techniques. Besides, the experimental results also validated the stand of not considering accuracy as the only performance evaluation metrics for SDP models. Conclusively, more performance metrics other than predictive accuracy should be considered when ranking and evaluating machine learning models.*

**Keywords:** Ensemble; Multi-Criteria Decision Method; Software Defect Prediction

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