Predicting the Impact of Scope Changes on Project Cost and Schedule Using Machine Learning Techniques

Authors : Soheila Sadeghi

Abstract : In the dynamic landscape of project management, scope changes are an inevitable reality that can significantly impact project performance. These changes, whether initiated by stakeholders, external factors, or internal project dynamics, can lead to cost overruns and schedule delays. Accurately predicting the consequences of these changes is crucial for effective project control and informed decision-making. This study aims to develop predictive models to estimate the impact of scope changes on project cost and schedule using machine learning techniques. The research utilizes a comprehensive dataset containing detailed information on project tasks, including the Work Breakdown Structure (WBS), task type, productivity rate, estimated cost, actual cost, duration, task dependencies, scope change magnitude, and scope change timing. Multiple machine learning models are developed and evaluated to predict the impact of scope changes on project cost and schedule. These models include Linear Regression, Decision Tree, Ridge Regression, Random Forest, Gradient Boosting, and XGBoost. The dataset is split into training and testing sets, and the models are trained using the preprocessed data. Cross-validation techniques are employed to assess the robustness and generalization ability of the models. The performance of the models is evaluated using metrics such as Mean Squared Error (MSE) and R-squared. Residual plots are generated to assess the goodness of fit and identify any patterns or outliers. Hyperparameter tuning is performed to optimize the XGBoost model and improve its predictive accuracy. The feature importance analysis reveals the relative significance of different project attributes in predicting the impact on cost and schedule. Key factors such as productivity rate, scope change magnitude, task dependencies, estimated cost, actual cost, duration, and specific WBS elements are identified as influential predictors. The study highlights the importance of considering both cost and schedule implications when managing scope changes. The developed predictive models provide project managers with a data-driven tool to proactively assess the potential impact of scope changes on project cost and schedule. By leveraging these insights, project managers can make informed decisions, optimize resource allocation, and develop effective mitigation strategies. The findings of this research contribute to improved project planning, risk management, and overall project success.

Keywords : cost impact, machine learning, predictive modeling, schedule impact, scope changes
Conference Title : ICAIT 2024 : International Conference on Artificial Intelligence and Technology
Conference Location : Istanbul, Türkiye
Conference Dates : June 27-28, 2024