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Timing is Everything: Defining Project Review Periods Through Monte Carlo Simulation and Machine Learning

Project monitoring practices have significantly evolved over the past decades. Initially grounded in traditional methodologies such as Earned Value Management (EVM), these practices have advanced to incorporate control charts and sophisticated techniques utilizing Artificial Intelligence (AI) and Machine Learning (ML) algorithms to predict final project costs and durations. Despite these considerable multidisciplinary advancements, one fundamental question remains unanswered: When should a project be monitored? Our proposal aims to integrate several established techniques to define optimal review periods based on predefined criteria, thereby assessing whether the project will be delivered on time. Specifically, we combined the Earned Duration Management (EDM) methodology with Monte Carlo simulation to generate a comprehensive dataset. Machine Learning models, enhanced by the Boruta feature selection technique, were then applied to identify eight key review periods capable of predicting project delays, with minimal performance loss. The models demonstrated robust performance, with area under the receiver operating characteristic curve (AUROC) values of 0.78, 0.81, and 0.99 for each evaluation period, respectively. Additionally, given the highly correlated nature of the dataset, we conducted an experimental design encompassing various preprocessing techniques and machine learning models to evaluate the main effects of each factor on prediction performance.

Classification

Both methodology and application

Special/ Invited session

Keywords

Machine Learning, Monte Carlo simulation, Statistical Monitoring

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