A Novel Optimized Operation Rainforest Model for Predicting Construction Delay Intervals Caused by Design Change Orders

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Abstract:

Design change orders in construction projects often lead to significant scheduling and cost overruns. Despite their impact, the construction industry still lacks an objective standard for accurately determining the duration of schedule extensions. To address this gap, this study proposes an interpretable prediction model, Operation Rainforest Interval Prediction (ORFi), which integrates confidence interval estimation to forecast construction delays caused by design change orders. The ORFi model employs an ensemble of operation trees that collectively form multiple operation forests, resulting in a high-dimensional, multi-regression formulation capable of generating prediction intervals. Experimental results demonstrate that the proposed model outperforms several established AI-based methods, achieving superior reliability indices (RI) of 0.966 for training and 0.977 for testing datasets. A case study is also presented to validate the model's practicality and effectiveness in real-world scenarios. The findings provide practical insights for project stakeholders and contribute a standardized reference to support more informed project management decisions.

Keywords:

Change order, Schedule delay, Prediction interval, Explainable machine learning, Operation tree.