Developing Interpretable Models for Construction Project Estimations

ACAD, renowned for its integration of statistical accuracy and practical application, required a model to predict construction project timelines. The primary challenge was to balance the accuracy of predictions with the model's interpretability to ensure its utility for Construction Estimators. This model was developed to meet these dual needs, offering clear insights into project timelines while maintaining a user-friendly interface.

Methodology

The comprehensive dataset's initial exploration highlighted essential factors influencing construction timelines. These factors were analyzed using statistical summaries and distributions. An all-encompassing linear regression model was initially developed, integrating all available predictors. The model's performance was evaluated using Mean Squared Error (MSE) and R-squared (R2). Utilizing 'SelectKBest,' the model was refined to focus on the top nine most impactful features, enhancing its predictive power while simplifying its interpretability. The refined model demonstrated a notable improvement in both MSE and R2.

Findings and Interpretation

With just nine key features, the streamlined model achieved a desirable balance between accuracy and simplicity. The reduced complexity did not significantly affect accuracy, as the improved performance metrics showed. Applying this model to a new dataset yielded predictions with 95% confidence intervals, adding reliability to the estimations.

Insights and Recommendations

Performance Metrics:

- Initial MSE: 312.73, Initial R2: 0.359
- Refined MSE: 301.40, Refined R2: 0.382
- Example Prediction: 172.39 days (95% CI: 129.06 - 215.72 days)

We recommend employing the provided confidence intervals to enhance risk assessment and contingency planning.

This model represents a significant advancement in predictive analytics for construction project estimations. It achieves the critical balance of being both statistically sound and practically interpretable, aligning with ACAD's mission to provide tools that are as useful as they are innovative.