

Research on multivariate regression models and their application in forecasting problems

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Abstract: This study develops and evaluates multivariate regression models for forecasting applications, addressing the critical need for accurate predictive tools in data-driven decision-making. The research systematically investigates the theoretical foundations of multiple linear regression, including assumptions of normality, homoscedasticity, and multicollinearity, and explores advanced techniques such as stepwise selection and regularization to enhance model performance. A real-world forecasting problem is employed as a case study, where the model is trained on historical data and validated against out-of-sample observations. Key performance metrics, including R-squared, adjusted R-squared, and root mean square error (RMSE), are used to assess predictive accuracy. The results demonstrate that the optimized multivariate regression model significantly improves forecast precision compared to baseline univariate approaches, effectively capturing complex interdependencies among predictor variables. Furthermore, the study discusses practical implications and limitations, such as sensitivity to outliers and the risk of overfitting. This work contributes a robust methodological framework for applying multivariate regression in forecasting, offering valuable insights for researchers and practitioners in fields such as economics, environmental science, and business analytics.

Keywords: multivariate regression, forecasting, model, application