Assessing the Impact of Traffic-Related Challenges on Academic Performance: A Comparative Study of Statistical and Machine Learning Models

Md.Ghalib Faruqe, Niharika Ibrahim, Prosanta Paul, Sakib Rahman, Arifuzzaman Arif
Undergraduate Students of Computer Science and Engineering (CSE),
American International University-Bangladesh (AIUB),
Dhaka 1229, Bangladesh
23-50795-1@student.aiub.edu, 23-50785-1@student.aiub.edu
23-53097-3@student.aiub.edu, 23-51093-1@student.aiub.edu
22-47033-1@student.aiub.edu

Shuvo Kumar
Undergraduate Student of Electrical and Electronic Engineering (EEE),
American International University - Bangladesh (AIUB),
Dhaka 1229, Bangladesh
22-46474-1@student.aiub.edu

Md. Mortuza Ahmmed
Associate Professor,
Department of Mathematics,
American International University-Bangladesh (AIUB),
Dhaka 1229, Bangladesh
mortuza@aiub.edu

Abstract

This research evaluates the effectiveness of statistical and machine learning models in understanding the impact of traffic-related issues on academic performance. We analyzed a dataset of 80 survey responses exploring relationships between traffic frequency, stress levels, transportation costs, and academic outcomes. Our analysis included Ordinary Least Squares (OLS) regression, Poisson regression, Bayesian Ridge regression, and machine learning techniques like Support Vector Regression, Ridge Regression, Random Forest, and XGBoost. Data preprocessing involved MinMax scaling for numerical features and encoding for categorical variables. We focused on metrics such as missed classes and exam-related stress, assessing model performance using R^2, Mean Squared Error (MSE), and Mean Absolute Error (MAE). The OLS regression model excelled, achieving an R^2 of 0.743, MSE of 0.0192, and MAE of 0.1123. Both Bayesian Ridge and Poisson regression demonstrated solid performance. This study underscores the critical impact of traffic-related factors on academic success and illustrates the varying effectiveness of different predictive models. While machine learning models showed potential, they could not perform as well as statistical models due to data limitations. Therefore, additional tuning is necessary to optimize their performance.

Keywords
Traffic, Academic Performance, Machine Learning, Statistical Models.

Biographies

Md. Ghalib Faruqe is an undergraduate student in the Computer Science and Engineering department at American International University-Bangladesh. His academic interests include artificial intelligence and machine learning. This is his first abstract submission, showcasing his dedication to advancing knowledge in his field.

Md. Mortuza Ahmmed is an Associate Professor and Statistician at American International University-Bangladesh. Expertise in applying statistical methods to public health, education, and machine learning. He aims to equip students with the technical skills to drive meaningful change in society.

Arifuzzaman Arif is an undergraduate student in the Computer Science and Engineering department at American International University-Bangladesh. Interest in technology.

Prosanta Paul is an undergraduate student in the Computer Science and Engineering department at American International University-Bangladesh.

Sakib Rahman is an undergraduate student in the Computer Science and Engineering department at American International University-Bangladesh.

Shuvo Kumar is an undergraduate student in the Electrical and Electronic Engineering department at American International University-Bangladesh.

Niharika Ibrahim is an undergraduate student in the Computer Science and Engineering department at American International University-Bangladesh.