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Plagiarism Scan Report

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This dataset captures the details of how CO2 emissions by a vehicle can vary with the different features. The dataset has been taken from Canada Government official open data website. This is a compiled version. This contains data over a period of 7 years. There are few abbreviations that has been used to describe the features. They are listed Below. The same can be found in the Data Description sheet: • Model: 4WD/4X4 = Four-wheel drive, AWD = All-wheel drive, FFV = Flexible-fuel vehicle, SWB = Short wheelbase, LWB = Long wheelbase, EWB = Extended wheelbase. • Transmission: A = Automatic, AM = Automated manual, AS = Automatic with select shift, AV = Continuously variable, M = Manual, 3 - 10 = Number of gears. • Fuel type: X = Regular gasoline, Z = Premium gasoline, D = Diesel, E = Ethanol (E85), N = Natural gas. • Fuel Consumption: City and highway fuel consumption ratings are shown in litres per 100 kilometres (L/100 km) - the combined rating (55% city, 45% hwy) is shown in L/100 km and in miles per gallon (mpg). • CO2 Emissions: The tailpipe emissions of carbon dioxide (in grams per kilometre) for combined city and highway driving Linear regression is a fundamental supervised learning algorithm used for predicting a continuous target variable based on one or more input features. In your project, it's used to model the relationship between fuel consumption and various vehicle specifications. It assumes a linear relationship between the features and the target variable, making it suitable for tasks where you want to make numerical predictions. Linear regression finds the best-fit line by minimizing the sum of squared differences between predicted and actual values. It's a simple yet effective algorithm for regression tasks. 4.2.2. Ridge Regression: Ridge regression is a regularization technique that extends linear regression. It's used to mitigate the problem of multicollinearity and overfitting by adding a regularization term to the linear regression cost function. In your project, ridge regression helps in selecting the most relevant features and prevents the model from becoming too complex. It's a useful choice when there are many features, and it adds a penalty term to the loss function, which encourages small coefficients. This makes it robust when dealing with data where several features are correlated. 4.2.3. Lasso Regression: Lasso regression, like ridge, is a regularization technique applied to linear regression. It is used to prevent overfitting and feature selection by adding an L1 regularization term to the cost function. Lasso helps in shrinking the coefficients of less important features to zero, effectively removing them from the model. In your project, lasso regression assists in identifying the most significant vehicle specifications affecting fuel consumption. It's particularly valuable when you suspect that many features may be irrelevant, and you want to perform automatic feature selection. 4.2.4. Elastic Net Regression: Elastic Net is a combination of both ridge and lasso regularization techniques. It balances the advantages of both approaches, making it a versatile choice for regression tasks. In your project, elastic net regression is used to address multicollinearity, overfitting, and feature selection simultaneously. It incorporates both L1 and L2 regularization terms, allowing you to control the strength of each. This flexibility makes it suitable when you're uncertain about the importance of features and their correlations. Elastic net provides a compromise between the L1 and L2 regularization methods, delivering a well-balanced and robust model. These algorithms collectively enable us to build regression models that predict vehicle fuel consumption based on a range of specifications, while also handling issues like overfitting and feature selection. 1. Model Loading: The code loads four pre-trained regression models, including Linear Regression, Ridge Regression, Lasso Regression, and Elastic Net Regression. 2. Data Preparation: The application reads fuel consumption data from a CSV file and organizes it by car make and model. It then allows users to select a specific car make. 3. Prediction Comparison: When a user selects a car make and enters fuel consumption values, the application uses each of the four models to predict the CO2 emissions for the given input. 4. Comparison Metrics: It calculates the absolute difference between each model's prediction and the actual CO2 emissions from the dataset. The model with the smallest difference is considered the "best" for that particular input. It also calculates an error percentage to quantify the prediction accuracy. 5. Visualization: The application displays the best model for the given input along with its closest prediction and error percentage. The goal is to estimate the error in predicting a vehicle's CO2 emissions using various machine learning models. When a user selects a model for prediction, the application iterates through several machine learning models (linear_model, ridge_model, lasso_model, elastic_net_model) to make predictions. For each model, it calculates the absolute difference between the model's prediction and the actual CO2 emissions value from the dataset. The "closest_prediction" is updated if the current model's prediction has a smaller absolute difference compared to the previous models. The error rate is then computed as an error percentage. It considers the "closest_difference" (the smallest absolute difference) and divides it by the actual CO2 emissions value from the dataset. This result is multiplied by 100 to express the error as a percentage. Here's how the comparison between different models works: 1. Selection of Vehicle Makes: Users are presented with two dropdown lists, "Select Make 1" and "Select Make 2." These dropdowns are populated with vehicle makes using data from the backend, making it easy for users to select the make of the first and second vehicles they want to compare. 2. Populating Model Dropdowns: As users select a make from the "Select Make 1" and "Select Make 2" dropdowns, a JavaScript function, `populateModels()`, dynamically updates the available models for that make in the "Select Model 1" and "Select Model

2" dropdowns. This ensures that users can only select models that belong to the chosen makes, preventing invalid comparisons.

Sources

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CO2 Emission by Vehicles

https://www.kaggle.com/datasets/debajyotipodder/co2-emission-by-vehicles

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Web · The dataset has been taken from Canada Government official open data website. And the data covers a period of 7 years. From the raw dataset, we generated ...

https://www.sciencedirect.com/science/article/pii/S0306261922002355

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https://github.com/piyushmalu23/CO2-Emission-by-Vehicles/

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Problem set 5 - Multivariate data analysis

https://rpubs.com/chris_kaalund/67248

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