**Department of Computing**

**CS 471: Machine Learning**

**BESE 12AB**

**Lab 04-Regularization**

**Date: 1 Mar 2024**

**Time: 09:00 AM-01:00 PM & 02:00 PM-5:00 PM**

**Instructor: Dr. Hashir Kiani & Dr. Daud Asif Abdullah**

**Lab 04-Regularization**

**Introduction**   
Linear Regression, L1 Norm (Lasso Regression) and L2 Norm (Ridge Regression) are fundamental techniques in machine learning, widely used for predictive modeling and data analysis.

**Objective**

This lab is designed to deepen your understanding of regression techniques through practical exercises in Google Colab and gain data insights using EDA.

**Tools/Software Requirement**

Google Colab

**Description and tasks**

Please following tasks.

**Task:**

1. Import the necessary libraries and load the auto-mpg data.
2. Perform data preprocessing, including, finding data shape, missing values and filling/removing them, ensuring correct datatypes, removing unnecessary columns, handling duplicate values, plotting histograms and printing correlation matrix etc.
3. Split the dataset into training and testing sets with 70-30 ratio and random state as 42.
4. Linear regression

* Fit a linear regression model to the training data using scikit-learn.
* Evaluate the model's performance using mean squared error (MSE) and R-squared metrics.
* Visualize the model's predictions against the actual values using matplotlib.
* Analyze the coefficients obtained from the linear regression model to understand feature importance.

1. L1 Norm (Lasso Regression) and L2 Norm (Ridge Regression):

* Fit Lasso and Ridge regression models to the training data using scikit-learn.
* Find the optimal value of alpha using gridsearch algorithm.
* Evaluate the models' performance using metrics like MSE.
* Compare the coefficients obtained from Lasso and Ridge regression.
* Compare the coefficients obtained from Lasso and Ridge regression to understand the impact of regularization.

**Deliverable**

Students are required to upload the lab task solution in. ipynb format on LMS.