ML LAB 4

09/09/2025

Dataset

Housing Prices Dataset on Kaggle: https://www.kaggle.com/datasets/vassreh/housing-prices-dataset
Numerical feature inputs: area, bedrooms, bathrooms, stories, parking as

Target: price

Q1. LASSO Regression

a) Implement LASSO Regression using the following objective function:

$$J(\theta) = \frac{1}{2n}\sum_{i=1}^{n}(h_\theta(x^{(i)}) - y^{(i)})^2 + \alpha\sum_{j=1}^{m}|\theta_j|$$

where:
- hθ(x) is the prediction,
- α is the regularization parameter.

b) Try at least two or more different values of α in your implementation. Evaluate the models using Mean Squared Error (MSE) and R^2 score, and record how the choice of α affects the results.

Q2. ElasticNet Regression

a) Implement ElasticNet Regression using the following objective function:

$$J(\theta) = \frac{1}{2n}\sum_{i=1}^{n}(h_\theta(x^{(i)}) - y^{(i)})^2 + \alpha\left(\lambda_1\sum_{j=1}^{m}|\theta_j| + \lambda_2\sum_{j=1}^{m}\theta_j^2\right)$$

where:
- α controls the strength of regularization,
- λ_1 and λ_2 balance between LASSO and Ridge penalties.

b) Experiment with different values of α and l1_ratio. Compare the model's performance using MSE and R^2 score, and report how the parameter choices affect the results compared to LASSO.

Q3. Polynomial Regression

a) Load the dataset and select "area" as the input feature and "price" as the target.

b) Transform the input feature using polynomial terms as:

$$[x, x^2, x^3, \ldots, x^d]$$

for polynomial degrees d = 2, 3, 4.

c) Implement Polynomial Regression using PolynomialFeatures and LinearRegression. Evaluate the models using MSE and R^2 score.

Q4. Hyperparameter Tuning using GridSearch and Randomized Search

a) Define a parameter grid to search for the optimal polynomial degree K.

b) Use GridSearchCV to find the best value of K by performing cross-validation. Report the best polynomial degree and the corresponding MSE and R^2 score.

c) Similarly, use RandomizedSearchCV to search for the optimal polynomial degree K.