

## CS-770 Machine Learning

### Assignment 1: Linear regression

**Due date: 09/24/2025**

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- Submit a separate PDF report and code file.
  - Prepare a comprehensive report documenting all aspects of the assignment.
  - Ensure that your PDF report is well-structured, with clear headings, figures, and tables to present your findings effectively.
  - Submit separate code files written in Python (.py format) for data preprocessing, model training, and evaluation.
  - Ensure that the code is well-commented, organized, and follows best practices in programming.
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**Q1 Perform the regression analysis using the California Housing dataset (50 points).**

**Task 1: Data Exploration and Preprocessing (25 points).**

- Exploratory Data Analysis (EDA): Perform a comprehensive EDA on the dataset. Visualize the distribution of the target variable and important features using histograms, box plots, and scatter plots.
- Feature Scaling: Discuss the importance of feature scaling in regression analysis.

**Task 2: Regression Analysis (25 points).**

- Model Implementation: Using the provided code as a base, implement linear, ridge, lasso, and OLS regression models.
- Model Evaluation: Evaluate each model's performance using the R<sup>2</sup> score and Mean Squared Error (MSE). Discuss the implications of these metrics in the context of model selection.
- Report results for simple and multiple linear regression.

**Q2. Perform the regression analysis using Fish dataset (50 points).**

**Task 1: Linear regression (25 points).**

- Fit a predictive linear regression model to estimate weight of the fish from its length, height, and width? (the data source fish.csv is provided).
- Report the coefficients values by using the standard Least Square Estimates.
- What is the standard error of the estimated coefficients, R-squared term.

**Task 2: Ridge and Lasso Regression (25 points).**

- Fit the Ridge and Lasso Regression Models
- Report the coefficients for Ridge and Lasso Regression models and the error of the estimated coefficients, R-squared term.