z**Sonar Rock vs Mine Classification**

This project focuses on building a machine learning model to classify sonar signals as either rocks or mines using Logistic Regression.

**Overview**

Sonar signals are used to detect and classify objects underwater. This classification task helps in identifying whether the detected object is a rock (R) or a mine (M) based on the sonar data. The dataset used contains 208 samples with 60 features each, representing frequency-based energy measurements.

## **Workflow**

1. **Loading the Data** The sonar dataset is loaded into a Pandas DataFrame for exploration and analysis.
2. **Data Preprocessing** Basic statistical analysis is done to understand feature distributions.  
     
    The label column (column 60) is separated from the features.
3. **Train-Test Split** The data is split into training and testing sets using an 90/10 ratio, while preserving the class distribution through stratification.
4. **Model Building** A Logistic Regression model is trained on the training data to learn the patterns and relationships between input features and labels.
5. **Model Evaluation** The model is evaluated on both training and testing data.  
   * Training accuracy: ~83%
   * Testing accuracy: ~76%
6. **Prediction System** A simple prediction pipeline is built where new sonar data can be input to get a classification result (Rock or Mine).

## **Conclusion**

The model provides a baseline solution for sonar-based object classification using a simple yet effective algorithm. It demonstrates the applicability of logistic regression in binary classification problems.