Corrosion Detection & Severity Level Prediction Using ML Techniques

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INTRODUCTION

CORROSION

Corrosion is defined in the corrosion definition of the American Society for Testing and Materials as "the chemical or electrochemical reaction between a material, typically a metal, and its environment that results in the material's degradation and loss of qualities."

PROBLEM

Corrosion as a Industry Hazard

- Corrosion failures have caused more than $2 trillion dollars in losses around the world. Steel pipes have surpassed all other modes of oil and gas transportation in the previous 50 years.
- As a result of transporting corrosive substances, the life expectancy of these pipes has been reduced more rapidly than anticipated, owing to internal and exterior corrosion.

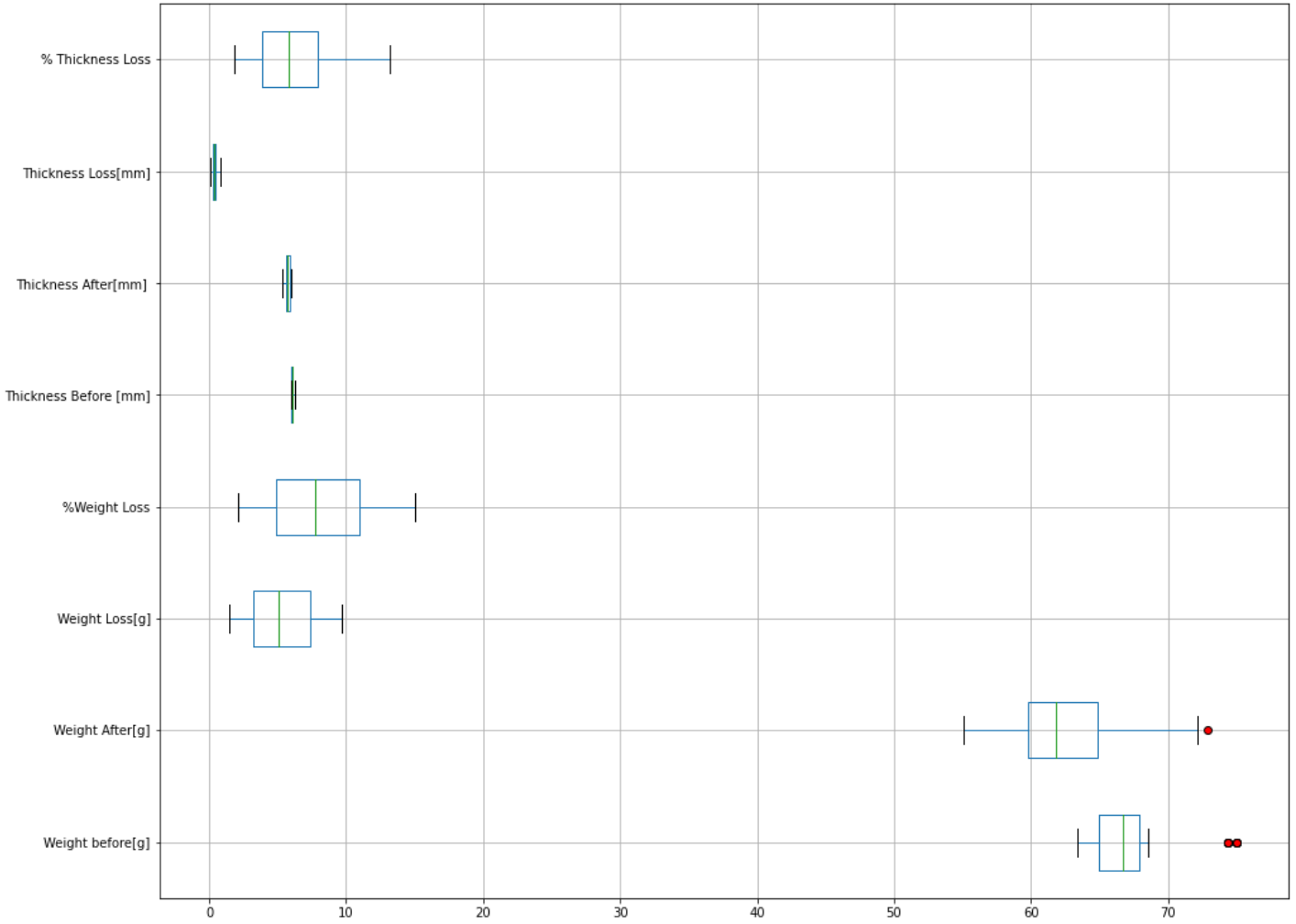
OBJECTIVES

What are we Aiming For?

- Corrosion Severity Level detection and prediction from data acquired through Lab Experiments.
- Comparative study of various Supervised Machine Learning Methods to classify corrosion seriousness level.

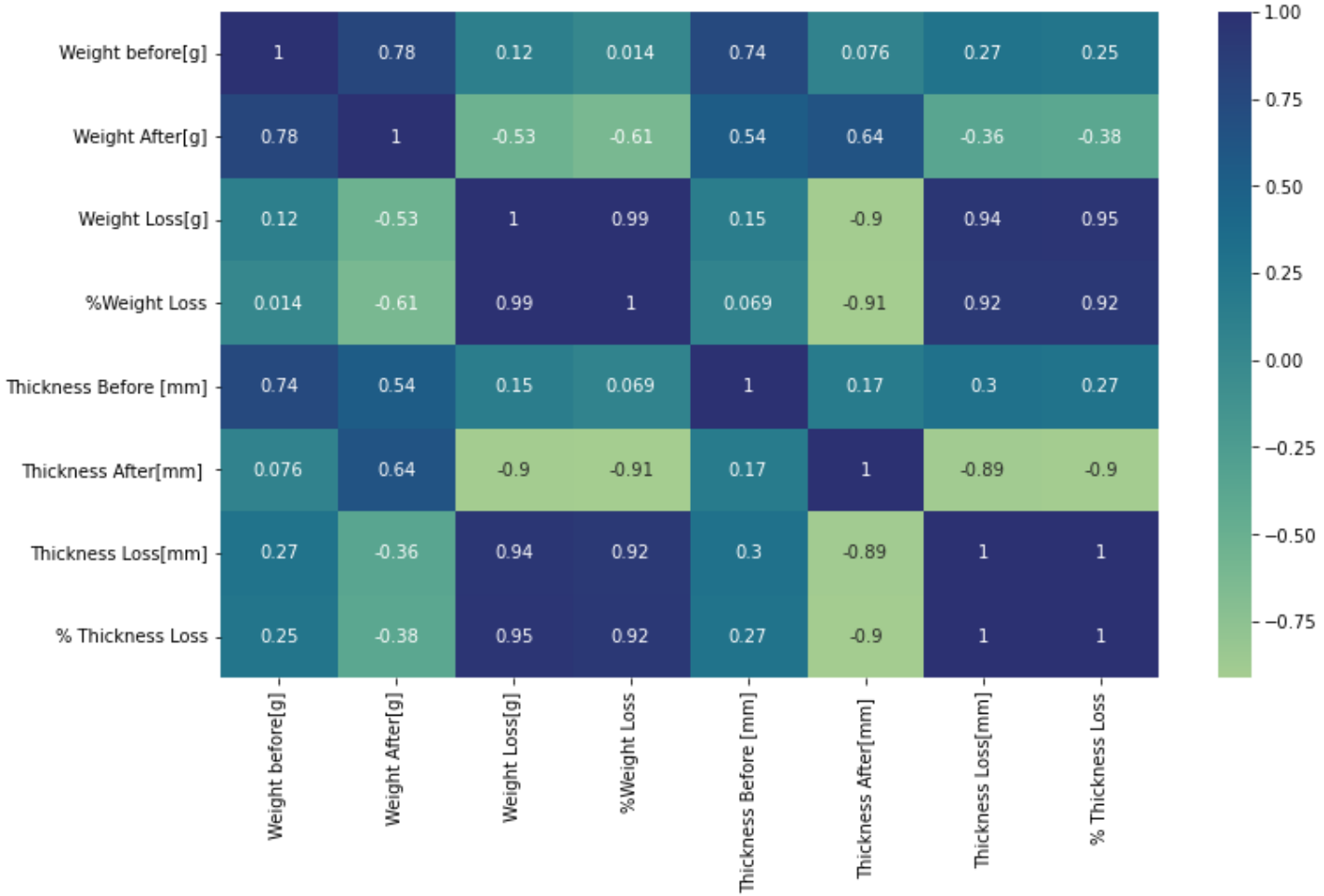
Our Solution

- We will use data generated from lab to develop a predictive model to classify corrosion using ensemble machine learning(Bagging & Boosting Algorithms).



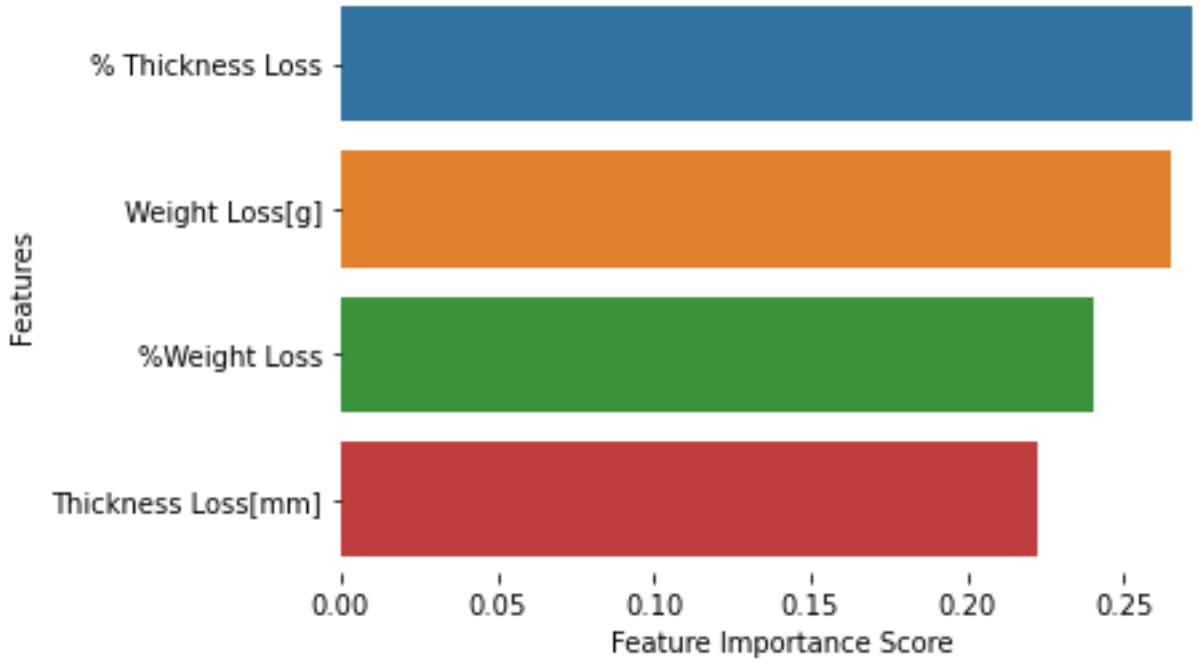
Exploratory Data Analysis

- Outliers Detection
- We can see deviation from usual pattern only in weight before the corrosion and weight after the corrosion columns.



Exploratory Data Analysis

- Correlation
- Thickness & Weight loss with time shows greater correlation with eachother

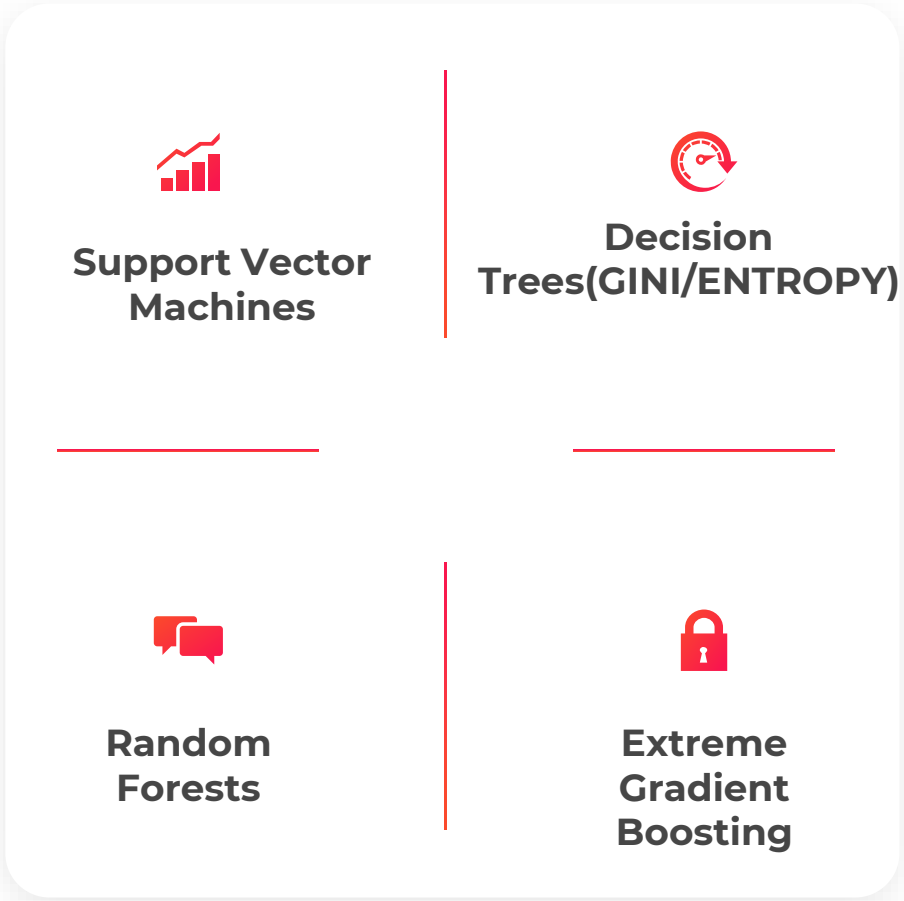


Exploratory Data Analysis

- Feature Extraction
- We used random forests to extract relevant training features for our Machine Learning Models.

MODEL SELECTION

- In order to predict the corrosion severity level, classes were assigned based on the experimental time, thickness and mass loss occurred during accelerated corrosion.
- For classification, we employed multiclass algorithms like Decision Tress, Random Forests, Support Vector Machines and Extreme Gradient Boosting to find the best performing classifier.



Machine Leaning Models

Decision Trees

Decision Trees is one of the oldest and prominent machine learning methods. A decision tree models the decision logics i.e., tests and related outcomes for classifying data items into a tree-like structure.

SVM

SVM can be used for both linear & nonlinear classification by altering the kernel functions that are used in the classification. In SVM, the data is translated onto a higher-dimensional feature space, where a hyperplane separating the classes is discovered by the use of kernel functions.

Ensemble Models

- A random forest (RF) is an ensemble classifier composed of numerous DTs, much like a forest is composed of numerous trees.
- When using gradient boosting, new models are built that forecast the residuals of earlier models, and these new models are combined to make the final prediction.

THANK YOU