HIGH LEVEL DESIGN

(HLD)

Concrete Compressive Strength Prediction

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# Document Version Control

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# Abstract

We analyze the various properties of concrete to predict its compressive strength. All regression models present in pycaret library have been used to compare and contrast the performance of these algorithms.

Training dataset was used for training model and that training model helped to come up with some predictions. Then the predicted amount was compared with actual data to test and verify the model accuracy. Later accuracies of all these models were compared. It was gathered that Light Gradient Boosting machine performed better than the remaining models.

# Introduction

## Why this High-Level Design Document?

The purpose of this High-Level document is to add necessary details to current project description to represent a suitable model for coding. This document is used as a reference manual for how the model interact at a high-level.

### The HLD will

* + - Presents all design aspects and define them in detail.
    - Describe the user interface being implemented.
    - Describe the hardware and software interfaces.
    - Describe the performance requirements.
    - Include design feature and the architecture of the project.

## Scope

The HLD document presents the structure of the system, such as the database architecture, application architecture, and technology architecture. The HLD uses non-technical to middle-technical terms which should be understandable to the administrators of the system.

## Definitions

|  |  |
| --- | --- |
| **Term** | **Descriptio n** |
| Database | Collection of all the information |
| ID E | Integrated Development Environment |
| AP I | Application Programming Interface |
| KP I | Key Performance Indicator |
| VS Code | Visual Studio Code |
| EDA | Exploratory Data Analysis |

# General Description

## Product Perspective

The Concrete Compressive Strength Prediction is a machine learning based predictive model which will help us to predict the Compressive Strength of the concrete.

## Problem Statement

To develop an API interface to predict the compressive strength of concrete its mixture properties and to create API interface to predict the premium

## Proposed Solution

The solution proposed here is an estimating compressive strength of the concrete based on its mixture properties and this can be implemented to perform above mention use cases. And we will be making an interface to predict the compressive strength of the concrete.

## Further Improvements

## Technical Requirements

The solution can be a cloud-based or application hosted on an internal server or even be hosted on a local machine. For accessing this application below are the minimum requirements:

* Good internet connection.
* Web Browser.

For training model, the system requirements are as follows:

+4 GB RAM preferred

* Operation System: Windows, Linux, Mac
* Visual Studio Code / Jupyter notebook

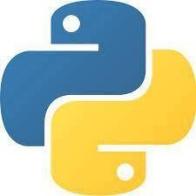
## Data Requirements

Data requirements completely depends on out problem statement.

* Comma separated values (CSV) file.
* Input file feature/field names and its sequence should be followed as per decided.

## Tools Used

Python programming language and frameworks such as NumPy, Pandas, Scikit-learn, Pycaret, Flask are used to build the whole model.







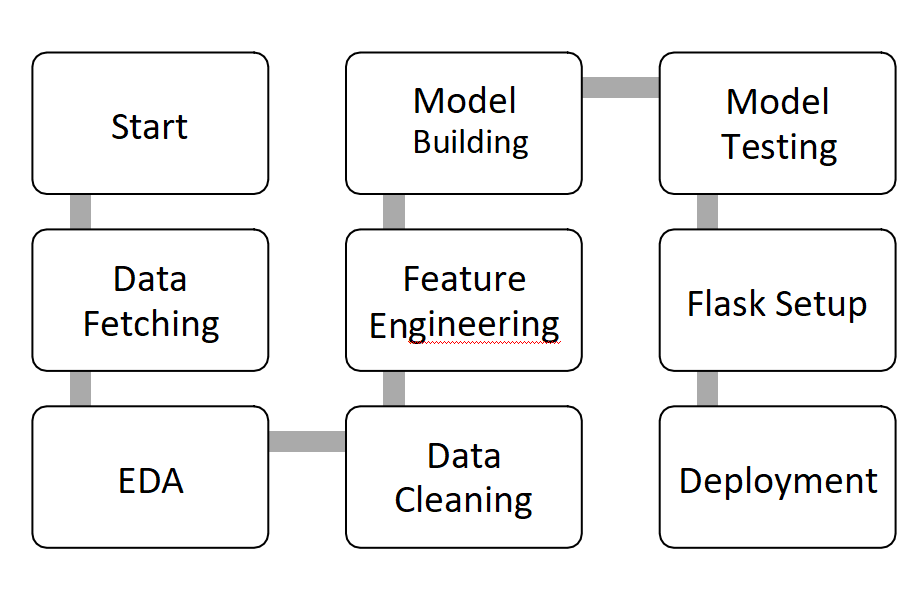
* Pandas is an open-source Python package that is widely used for data analysis and machine learning tasks.
* NumPy is most commonly used package for scientific computing in Python.
* DVC is used for MLOps tool for Continuous integration
* Seaborn is an open-source data visualization library used to create quality charts/graphs.
* Scikit-learn is used for a machine learning.
* Pycaret is used for experimentation of different machine learning models
* Flask is used to build API.
* VS Code is used as IDE (Integrated Development Environment)
* GitHub is used as version control system.
* Front end development is done using HTML/CSS.
* Heroku is used for deployment of the model.

## Assumptions

The main objective of the project is to develop an API to predict the Compressive strength of the concrete. Machine learning based regression model is used for predicting above mentioned cases on the input data.

# Design Details

## Process Flow



## Event Log

The system should log every event so that the user will know what process is running internally.

**Initial Step-By-Step Description:**

* The system identifies at what step logging required.
* The system should be able to log each and every system flow.
* Developer can choose logging method. You can choose database logging.

System should not hang out even after using so many loggings.

# Performance

## Reusability

The entire solution will be done in modular fashion and will be API oriented. So, in the case of the scaling the application, the components are completely reusable.

## Application Compatibility

The interaction with the application is done through the designed user interface, which the end user can access through any web browser.

## Deployment



# 5.0 Conclusion

This system shows us that the different techniques that are used in order to estimate the compressive strength of concrete on the basis of its mixture properties. From the results, we could see that Light Gradient Boosting Machine turned out to be best working model for this problem in terms of the accuracy. Our predictions help user to know compressive strength of the concrete.