PROJECT REPORT

Predicting Compressive Strength Of Concrete

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1. INTRODUCTION

1.1 Overview

Concrete is a material used in construction that has great versatility and is used across the globe. Concrete has several advantages, including good compressive strength, durability, workability, construction availability, and low cost. Determining accurate concrete strength is a major civil engineering problem. The traditional way to know the strength of concrete will take about 28 days which is very time-consuming. It is important to wait 28 days to ensure the quality control of the process, although it is very time-consuming. This project aims at building a Machine Learning model to predict the compressive strength of concrete to greatly speed up prediction with higher accuracy. A web application is built where the user can enter the required parameters and see the predicted results on the Web Application.

1.2 Purpose

The ultimate goal of the project is to analyze the concrete compressive strength dataset and build Machine Learning models to predict the compressive strength. Thereby it improves the specifications and quality assurance procedures for cement concrete pavements

2. LITERATURE SURVEY

2.1 Existing Problem

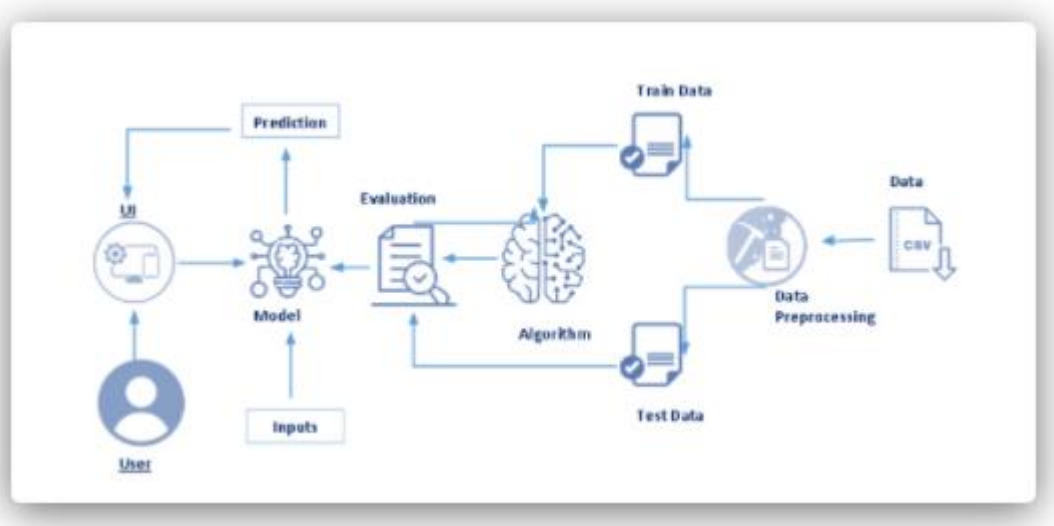
* Time-consuming: The traditional way to know the strength of concrete will take about 28 days which is very time-consuming. It is important to wait 28 days to ensure the quality control of the process, although it is very time-consuming
* Low quality of raw materials
* Less compressive strength
* Difficult to determine accurate concrete strength

2.2 Proposed System

This project “Predicting Compressive Strength of Concrete “aims at building a machine learning model to predict the compressive strength of concrete to greatly speed up prediction with higher accuracy and ensure the quality and quantity of raw materials. A web application is build where user can enter the required parameter and see the predicted result on the web application.

3. THEORATICAL ANALYSIS

3.1 Block Diagram



3.2 Hardware /Software Designing

- Hardware

  Windows 10

- Software

  Anaconda Navigator: Anaconda Navigator is a free and open-source distribution of the Python and R programming languages for data science and machine learning-related applications. It can be installed on Windows, Linux, and macOS.Conda is an open-source, cross-platform, package management system. Anaconda comes with great tools like JupyterLab, Jupyter Notebook, QtConsole, Spyder, Glueviz, Orange, Rstudio, Visual Studio Code. For this project, we will be using Jupyter notebook and Spyder.

  To build Machine learning models you must require the following package

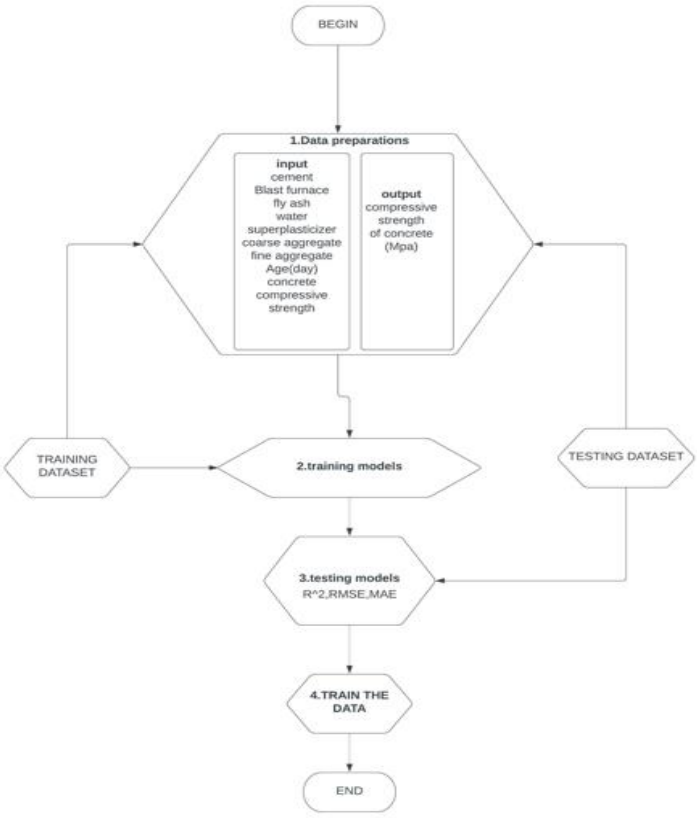
  - **Sklearn: Scikit-learn** is a library in Python that provides many unsupervised and supervised learning algorithms.
  - **NumPy: NumPy** is a Python package that stands for 'Numerical Python'. It is the core library for scientific computing, which contains a powerful n-dimensional array object

- **Pandas: pandas** is a fast, powerful, flexible, and easy to use open-source data analysis and manipulation tool, built on top of the Python programming language.
- **Matplotlib:** It provides an object-oriented API for embedding plots into applications using general-purpose,GUI,toolkits.
- **Flask:** Web framework used for building Web applications.

4. EXPERIMENTAL INVESTIGATION

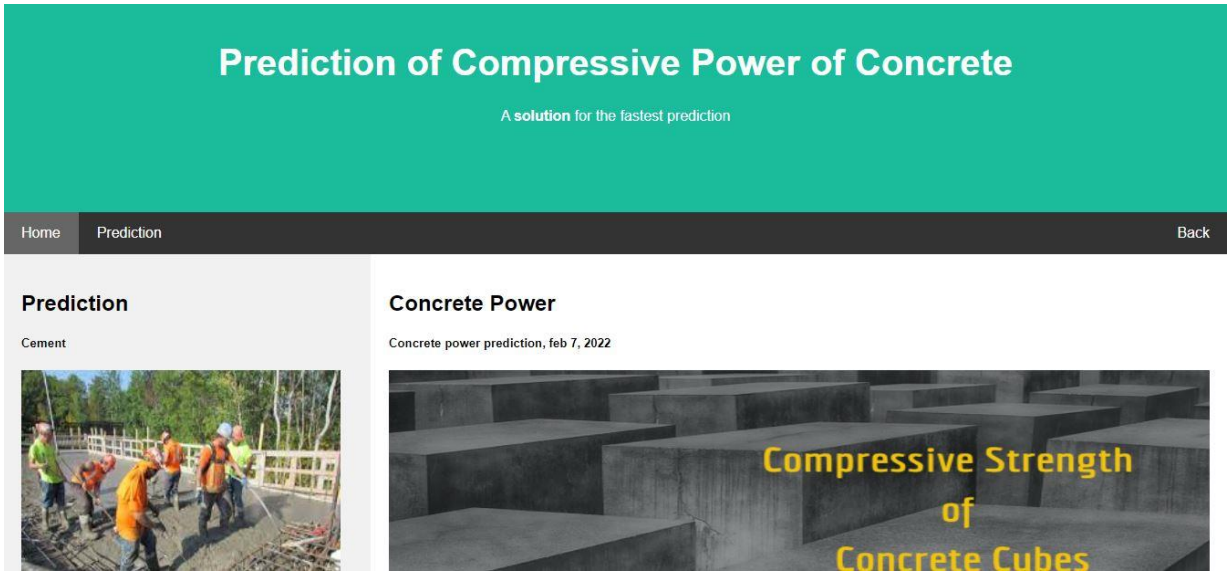
The dataset consists of 1030 instances with 9 attributes and has no missing values. There are 8 input variables and 1 output variable. Seven input variables represent the amount of raw material (measured in kg/m^3) and one represents Age (in Days). The target variable is Concrete Compressive Strength measured in (MPa — Mega Pascal). We shall explore the data to see how input features are affecting compressive strength. The first step in a Data Science project is to understand the data and gain insights from the data before doing any modeling. This includes checking for any missing values, plotting the features with respect to the target variable, observing the distributions of all the features, and so on. Let us import the data and start analyzing it.

5. FLOWCHART

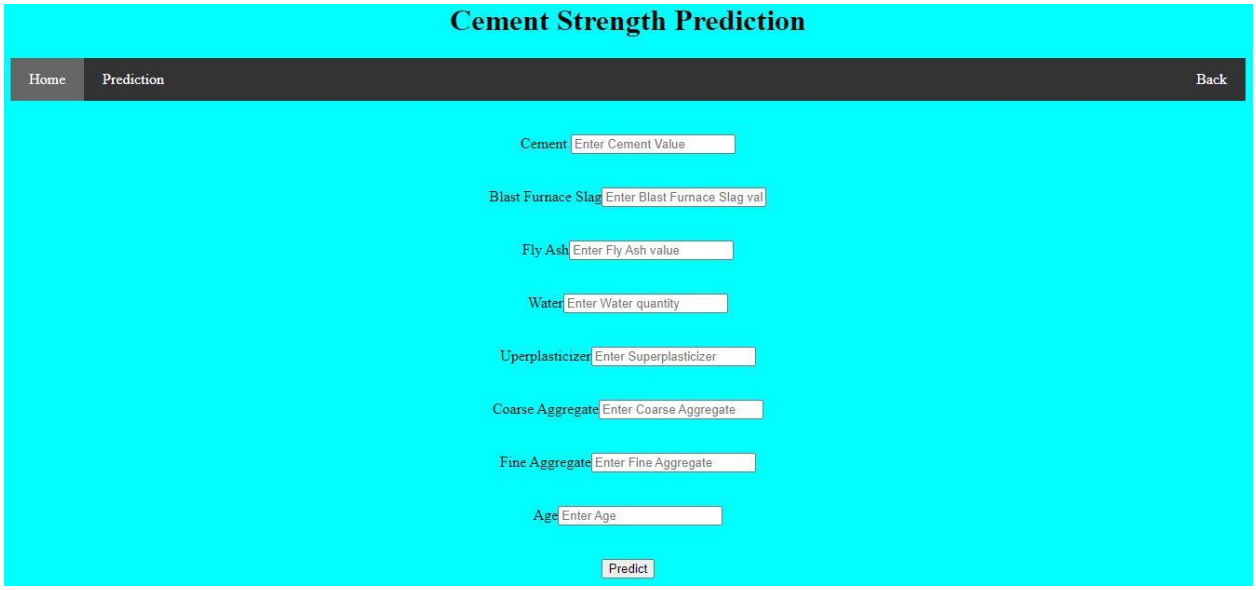


6. HTML PAGES

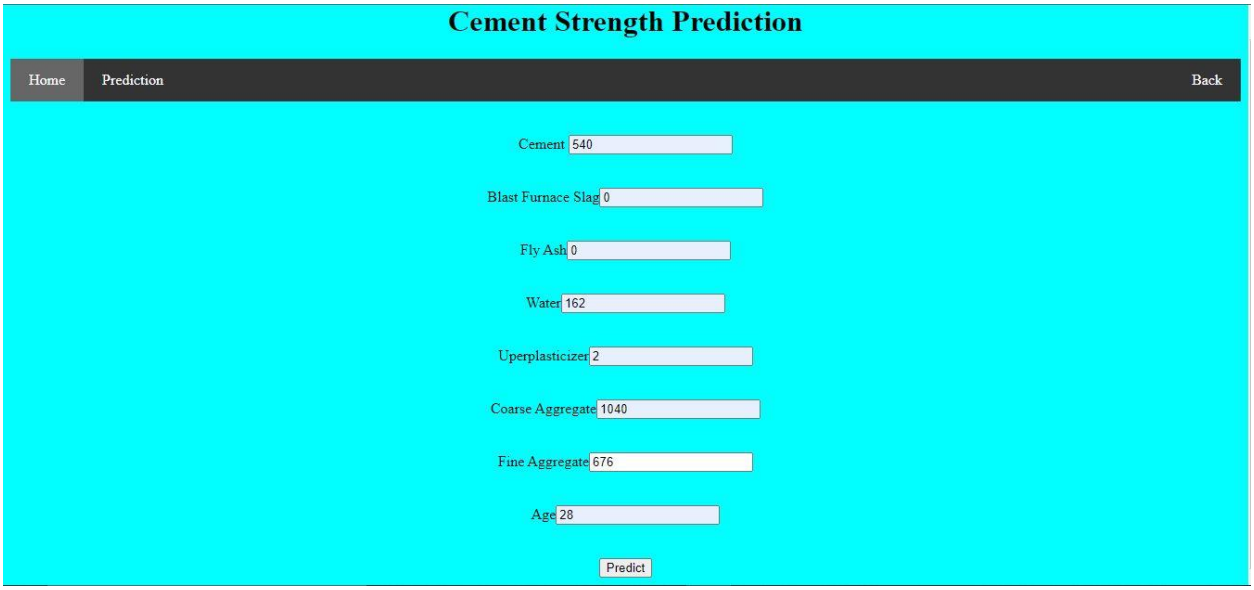
6.1 Home Page

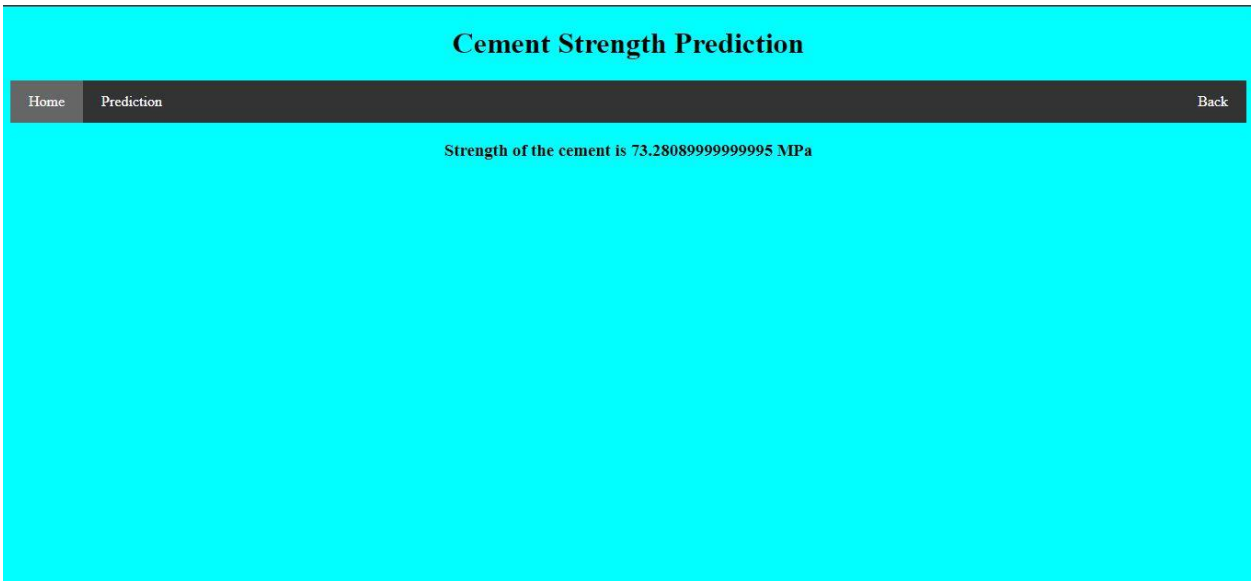


6.2 Search Page



6.3 Output Page





7. App.py Code

```
# importing the necessary dependencies
import numpy as np
from flask import Flask, request, render_template
import pickle
import pandas as pd
import os
import json
import requests

# NOTE: you must manually set API_KEY below using information retrieved from your IBM Cloud account.
API_KEY = "CZLGEcnrpCGDQ9lpj9PcayagQGD3KhoUgXOrwP1roN2L"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey": API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}


app = Flask(__name__) # initializing a flask app

@app.route('/')
def home():
    return render_template('home.html')
@app.route('/prediction')
def prediction():
    return render_template('search.html')
@app.route('/predict',methods=['GET','POST'])
def predict():
        #  reading the inputs given by the user

    Cement = request.form["Cement"]
    BlastFurnaceSlag = request.form["Blast Furnace Slag"]
    FlyAsh = request.form["Fly Ash"]
    Water = request.form["Water"]
    Superplasticizer = request.form["Superplasticizer"]
    CoarseAggregate = request.form["Coarse Aggregate"]
    FineAggregate = request.form["Fine Aggregate"]
    Age = request.form["Age"]
    t = [[int(Cement),int(BlastFurnaceSlag),int(FlyAsh),int(Water),int(Superplasticizer),int(CoarseAggregate),int(FineAggregate),int(Age)]]
    # NOTE: manually define and pass the array(s) of values to be scored in the next line
    payload_scoring = {"input_data": [{"field": [['Cement','Blast Furnace Slag','Fly Ash','Water','Superplasticizer','Coarse Aggregate','Fine Aggregate','Age']],"values": t}]}

    response_scoring = requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/1b9cc9ac-9344-4f8f-8183-52968cef55e2/predictions?version=2022-03-07', json=payload_scoring, headers={'Authorization': 'Bearer ' + mltoken})
    print("Scoring response")
    #predictions = response_scoring.json()
    #pred = response_scoring.json()
    #prediction = pred['predictions'][0]['values'][0][0]




    #print('prediction is', prediction)
    # showing the prediction results in a UI
    return render_template('result.html',prediction_text=response_scoring.json()['predictions'][0]['values'][0][0])

if __name__=="__main__":
    port=int(os.environ.get('PORT',5000))
    app.run(port=port,debug=True,use_reloader=False)
```

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import pickle

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import os

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API_KEY = "CZLGEcnrpCGDQ9lpj9PcayagQGD3KheUgXOrwPTroN2L"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey": API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

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```

```
    FineAggregate = request.form["Fine Aggregate"]

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    port=int(os.environ.get('PORT',5000))

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```

8. ADVANTAGES AND DISADVANTAGES

8.1 Advantages

- Easy to predict the strength of the cement
- Speed
- We can reduce the cost based upon the components
- Time management
- Availability of concrete ingredients easily.
- The property of concrete to possess high compressive strength, makes a concrete structure more economical than that of steel structure.
- Its also benefits for workers

8.2 Disadvantages

- If there is any error happens it affect the prediction

9. APPLICATIONS

- t is used to predict the strength of concrete for laying floors, roofs and constructing lintels, beams, stairs, pillars etc.
- It is used where a hard surface is required for the protection of exposed surfaces of structures against the destructive agents of the weather and certain organic or inorganic chemicals.
- It is recommended for precast pipes manufacturing, piles, fencing posts etc.
- It is used in the construction of important engineering structures such as bridges, culverts, dams tunnels, lighthouses etc.
- It is used in the preparation of foundation, watertight floors, footpaths etc.
- It is employed for the construction of wells, water tanks, tennis courts, lamp posts, telephone cabins, roads etc.

10. CONCLUSION

Concrete is a material used in construction that has great versatility and is used across the globe. Based on the traditional way, it's not easy to predict the strength of concrete. Now we can easily predict the strength of the concrete within a sec with the help of machine language. In our project "Predicting Compressive Strength of Concrete, " we can able to understand the problem to classify if it is a regression or a classification be kind of problem. And able to know how to pre-process/clean the data using different data pre-processing techniques. Here, we apply the Random forest model to find the accuracy .it's the best model. By providing the values we can able to predict the strength of the concrete. Cement and Age are treated as the most important features by r model. Fly ash, Coarse and Fine aggregates are the least important factors when predicting the Strength of Concrete.

11. FUTURE SCOPE

It's mainly useful in the civil engineering field. They can easily predict the strength without any time consuming

12. BIBILIOGRAPHY

www.smartinternz.com
https://www.researchgate.net/publication/