Prediction of Compressive Strength of Concrete

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Abstract

This is development of a use case. This deals with the problem of finding the Compressive Strength of Concrete with the help of some Parameters. For this we have taken a dataset from Kaggle. This method finds prediction for Strength of concrete on given inputs as parameters.

Problem Description

- Concrete is a material used in constructions, which has great versatility and which consists of good compressive strength,durability, workability.

- The major problem of Civil Engineering is to predict the compressive strength of cement so that it can be estimated to use the accurate amount of other materials to be used.

Use of Machine Learning

- Machine learning techniques are progressively used to simulate the environment for research area.

- Machine learning uses its models to predict the possibility for compressive strength of concrete.

- The ML uses a data set of various parameters that effect the strength of concrete.

Problem solution

- This is a problem of Regression
- The output can be predicted by using a continuous result
- The output is a continuous curve formed as result of regression function
- The projections from axes with respect to parameters in plots give the prediction

Types of Regression

- Regression can be broadly classified into :
  - Simple Linear Regression
  - Multiple Linear Regression
  - Polynomial Regression
  - Decision Tree
  - Ridge Regression
  - Lasso Regression
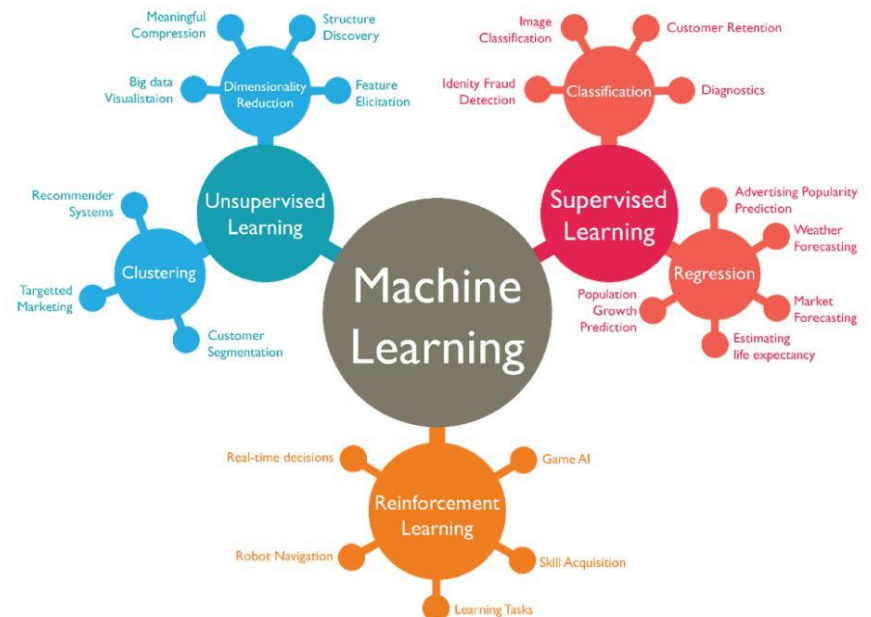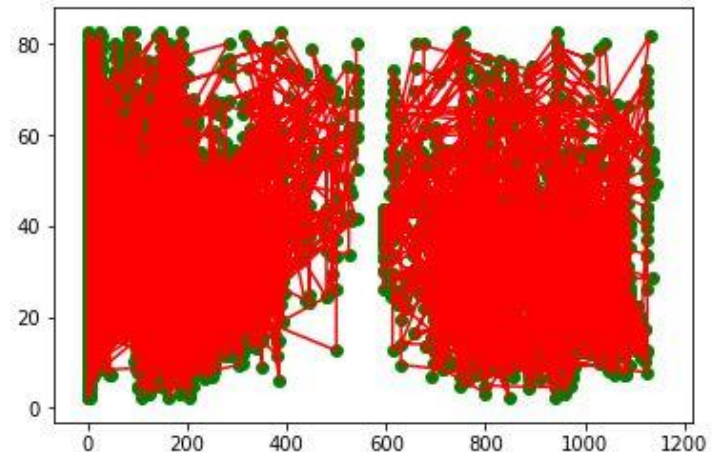
Simple Linear Regression

- This uses line "y=mx+c"
- This is used when there is only single independent variable.
- Here, there are multiple independent variables like Water component,Slag,cement, etc.,

◦ Sample of data

	cement	slag	ash	water	plasticizer	coarse	fine	age	strength
0	540.0	0.0	0.0	162.0	2.5	1040.0	676.0	28	79.99
1	540.0	0.0	0.0	162.0	2.5	1055.0	676.0	28	61.89
2	332.5	142.5	0.0	228.0	0.0	932.0	594.0	270	40.27
3	332.5	142.5	0.0	228.0	0.0	932.0	594.0	365	41.05
4	198.6	132.4	0.0	192.0	0.0	978.4	825.5	360	44.30

Multiple Linear Regression

- The problem has multiple independent variables

- Hence multiple Linear regression can be applied.

- The 'r2_score' for multiple Linear Regression is found as 63.69% for the taken dataset.

```
for i in range(count):
    c=dataset.iloc[0:,i:i+1].values
    r=dataset.iloc[0:,-1:].values
    mt.plot(c,r,color='red')
    mt.scatter(c,r,color='green')
    mt.xlabel=dataset.columns[i]
    mt.ylabel=dataset.columns[-1]
```

Polynomial Linear Regression

- In this regression we apply polyomial features for the data and then perform

- This uses a polynomial curve as plot for finding the prediction.

- This is used when the data is in exponential sequence.

- The 'r2_score' is found as 63.69%

Decision Tree Regression

- This uses Yes or no method for a given condition to predict the happening of event

- This can be used in both Regression and classification.

- This forms a tree structure and produces continuous output.

- The r2_score through this method is 0.7843

Ridge Regression

- This is an extension to linear regression
- This prevents the over fitting of model
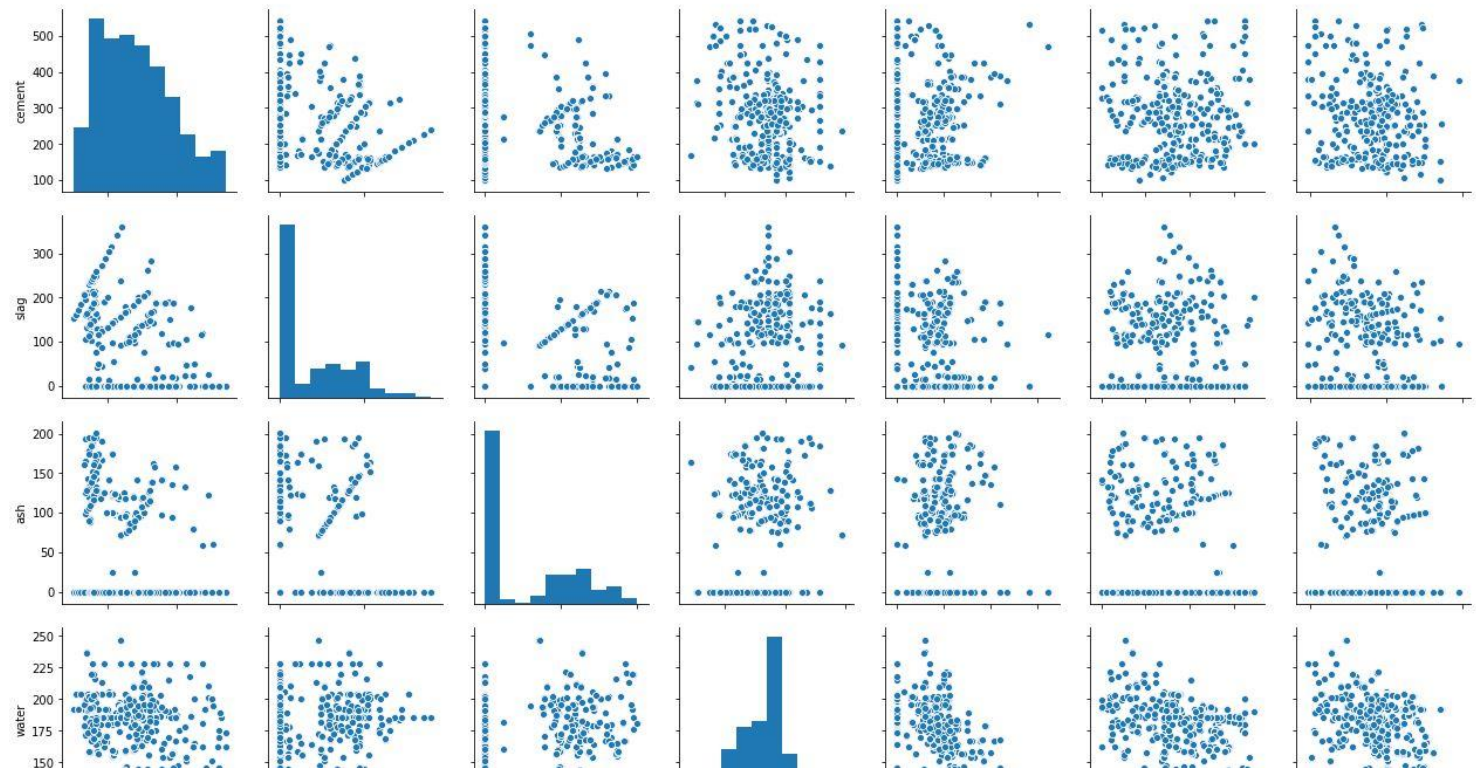- The r2_score through tis model is found as 0.6369

Comparison of models

- R2_score is found to be maximum in Decision Tree Regression
- Mean_absolute_error is found to be minimum in decision tree
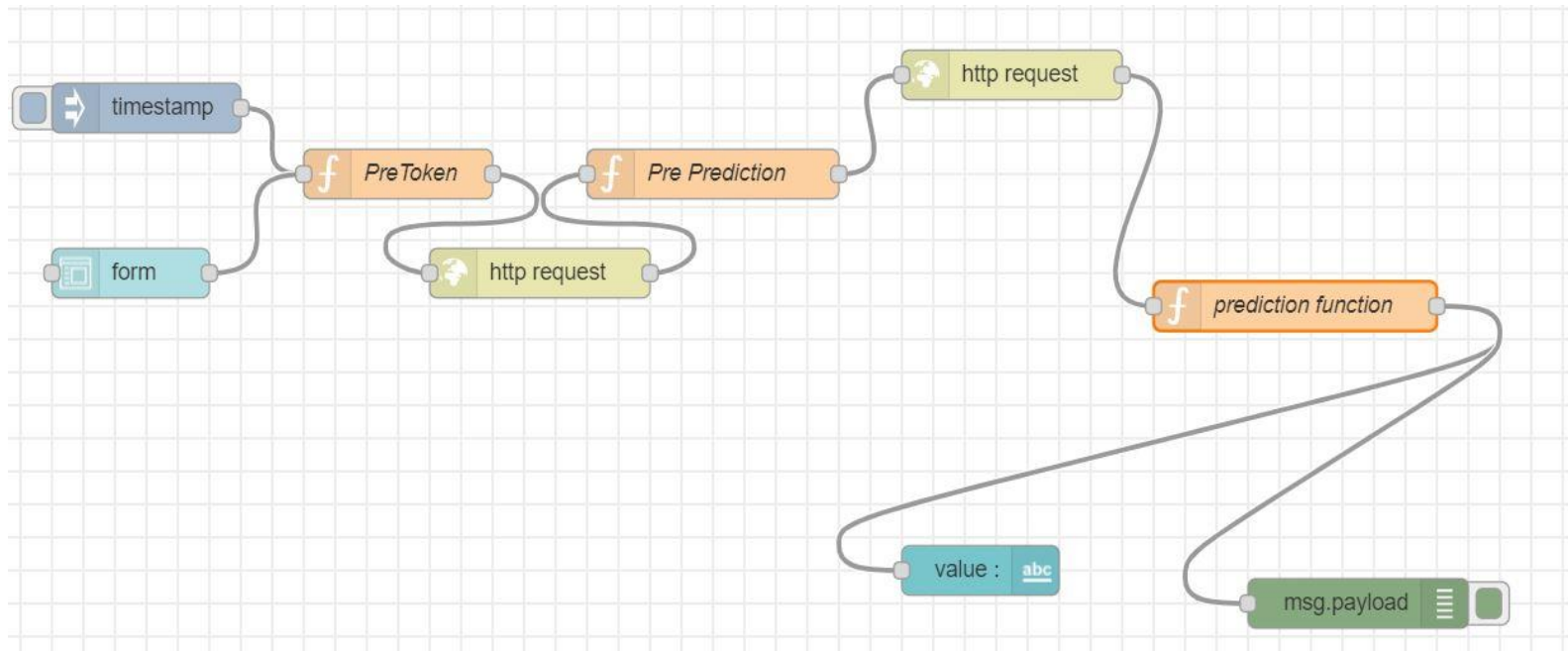
Plots generated for different parameters


```
: 1  #pairplots
  2  sn.pairplot(dataset)
```

39]: <seaborn.axisgrid.PairGrid at 0x7fb627d6fb00>

Deployment of solution through web service

- Flowchart for steps followed in web service

Output (prediction)

- The output is produced through web service as:

concrete strength

value :   4.4898492

Enter the cement content *
330

Enter the Blast Furnace Slag *
120

Enter the Fly Ash *
1

Enter the water component *
342

Enter the Superplasticizer *
2

Enter the Coarse Aggregate *
900

Enter the Fine Aggregate *
300

Enter the age(days) *
42

SUBMIT   CANCEL

Thank You