Concrete Strength Predictor

Intro to ML Final Project
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The Problem

Concrete

- Vital building material
- Strength essential for longevity
- Different mixtures result in different effects

Goal

- Being able to predict the resulting strength of concrete given the components
- This ability would help to save money and potentially lives

The Data

Data

Will be utilizing the Concrete Strength dataset found on Kaggle

https://www.kaggle.com/datasets/mchilamwar/predict-concrete-strength?resource=download

Data Features and our Target

CementComponent:- Amount of cement is mixed

BlastFurnaceSlag:- Amount of Blast Furnace Slag is mixed

FlyAshComponent:- Amount of FlyAsh is mixed

WaterComponent:- Amount of water is mixed

SuperplasticizerComponent:- Amount of Super plasticizer is mixed

CoarseAggregateComponent:- Amount of Coarse Aggregate is mixed

FineAggregateComponent:- Amount of Coarse Aggregate is mixed

AgeInDays:- How many days it was left dry

Strength:- What was the final strength of concrete- **(Target)**

Exploratory Data Analysis

Feature Data Types

	CementComponent	BlastFurnaceSlag	FlyAshComponent	WaterComponent	SuperplasticizerComponent	CoarseAggregateComponent	FineAggregateComponent	AgeInDays	Strength
count	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000
mean	281.167864	73.895825	54.188350	181.567282	6.204660	972.918932	773.580485	45.662136	35.817961
std	104.506364	86.279342	63.997004	21.354219	5.973841	77.753954	80.175980	63.169912	16.705742
min	102.000000	0.000000	0.000000	121.800000	0.000000	801.000000	594.000000	1.000000	2.330000
25%	192.375000	0.000000	0.000000	164.900000	0.000000	932.000000	730.950000	7.000000	23.710000
50%	272.900000	22.000000	0.000000	185.000000	6.400000	968.000000	779.500000	28.000000	34.445000
75%	350.000000	142.950000	118.300000	192.000000	10.200000	1029.400000	824.000000	56.000000	46.135000
max	540.000000	359.400000	200.100000	247.000000	32.200000	1145.000000	992.600000	365.000000	82.600000

Correlation Matrix
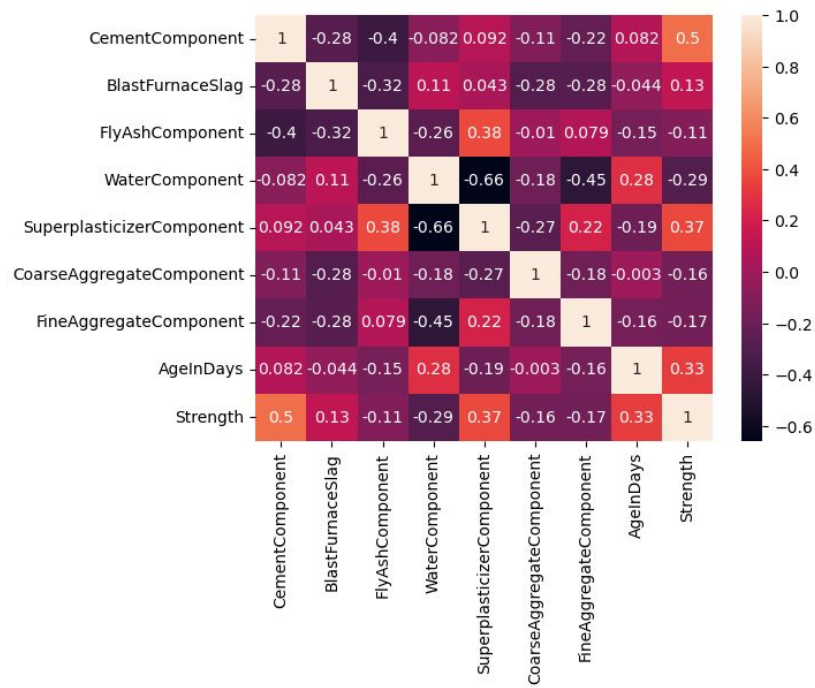
Feature Engineering

Feature Engineering

-   **Water / Cement Ratio**

    -   Ratio between the 'WaterComponent' and the 'CementComponent'

-   **Coarse / Fine Aggregate Component**

    -   Ratio between the 'CoarseAggregateComponent' and the 'FineAggregateComponent'

-   **Superplasticizer Component / Water Ratio**

    -   Ratio between the 'SuperplasticizerComponent' and the 'WaterComponent'

Modeling

Linear Regressor

- **LR0**   R^2 of 0.6

- **LR1**   R^2 of 0.45

- **LR2**   **R^2 of 0.58**

- **LR3**   R^2 of 0.58

KNN Regressor

-   **Neighbors = 2**   R^2 of 0.71

-   **Neighbors = 3**   **R^2 of 0.72**

-   **Neighbors = 4**   R^2 of 0.68

-   **Neighbors = 5**   R^2 of 0.68

Decision Tree Regressor

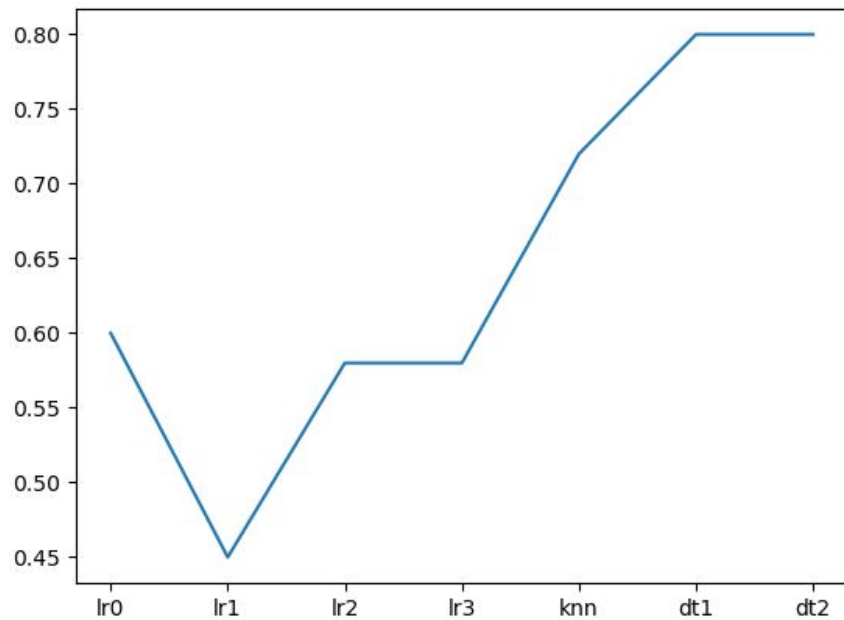- **DT1**   R^2 of 0.80

- **DT2**   **R^2 of 0.80**

Results and Analysis

Results

Links

Github Notebook - https://github.com/awyeh64/concrete/blob/main/concrete.ipynb

Kaggle - https://www.kaggle.com/datasets/mchilamwar/predict-concrete-strength?resource=download

Concrete Help 1 - https://theconstructor.org/concrete/factors-affecting-strength-of-concrete/6220/

Concrete Help 2 - https://www.concreteconstruction.net/how-to/materials/how-super-are-superplasticizers