⭐ Regression Model to Predict Cement Compressive Strength

```
# import library
import pandas as pd
```

```
# import data
cement = pd.read_csv('https://github.com/ybifoundation/Dataset/raw/main/Concrete%20Compressive%20Stre
```

```
# view data
cement
```

	Cement (kg in a m^3 mixture)	Blast Furnace Slag (kg in a m^3 mixture)	Fly Ash (kg in a m^3 mixture)	Water (kg in a m^3 mixture)	Superplasticizer (kg in a m^3 mixture)	Coarse Aggregate (kg in a m^3 mixture)	Fi Aggrega (kg in m mixtur
0	540.0	0.0	0.0	162.0	2.5	1040.0	67
1	540.0	0.0	0.0	162.0	2.5	1055.0	67
2	332.5	142.5	0.0	228.0	0.0	932.0	59
3	332.5	142.5	0.0	228.0	0.0	932.0	59
4	198.6	132.4	0.0	192.0	0.0	978.4	82
...	...	...	...	...	...	...	
1025	276.4	116.0	90.3	179.6	8.9	870.1	76
1026	322.2	0.0	115.6	196.0	10.4	817.9	81
1027	148.5	139.4	108.6	192.7	6.1	892.4	78
1028	159.1	186.7	0.0	175.6	11.3	989.6	78
1029	260.9	100.5	78.3	200.6	8.6	864.5	76

1030 rows × 9 columns

```
# info of data
cement.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1030 entries, 0 to 1029
Data columns (total 9 columns):
 #   Column                                        Non-Null Count  Dtype  
---  ------                                        --------------  -----  
 0   Cement (kg in a m^3 mixture)                  1030 non-null   float64
 1   Blast Furnace Slag (kg in a m^3 mixture)      1030 non-null   float64
 2   Fly Ash (kg in a m^3 mixture)                 1030 non-null   float64
 3   Water (kg in a m^3 mixture)                   1030 non-null   float64
 4   Superplasticizer (kg in a m^3 mixture)        1030 non-null   float64
 5   Coarse Aggregate (kg in a m^3 mixture)        1030 non-null   float64
 6   Fine Aggregate (kg in a m^3 mixture)             1030 non-null   float64
 7   Age (day)                                        1030 non-null   int64  
 8   Concrete Compressive Strength(MPa, megapascals)  1030 non-null   float64
dtypes: float64(8), int64(1)
memory usage: 72.5 KB
```

```
# summary statistics
cement.describe()
```

	Cement (kg in a m^3 mixture)	Blast Furnace Slag (kg in a m^3 mixture)	Fly Ash (kg in a m^3 mixture)	Water (kg in a m^3 mixture)	Su
count	1030.000000	1030.000000	1030.000000	1030.000000	
mean	281.165631	73.895485	54.187136	181.566359	
std	104.507142	86.279104	63.996469	21.355567	
min	102.000000	0.000000	0.000000	121.750000	
25%	192.375000	0.000000	0.000000	164.900000	
50%	272.900000	22.000000	0.000000	185.000000	
75%	350.000000	142.950000	118.270000	192.000000	
max	540.000000	359.400000	200.100000	247.000000	

```
# check for missing value
```

```
# check for categories
```

```
Cement (kg in a m^3 mixture)                        280
Blast Furnace Slag (kg in a m^3 mixture)            187
Fly Ash (kg in a m^3 mixture)                       163
Water (kg in a m^3 mixture)                         205
Superplasticizer (kg in a m^3 mixture)              155
Coarse Aggregate (kg in a m^3 mixture)              284
Fine Aggregate (kg in a m^3 mixture)                304
Age (day)                                            14
Concrete Compressive Strength(MPa, megapascals)     938
dtype: int64
```

```
# visualize pairplot
```

```
# columns name
cement.columns
```

```
Index(['Cement (kg in a m^3 mixture)',
       'Blast Furnace Slag (kg in a m^3 mixture)',
       'Fly Ash (kg in a m^3 mixture)', 'Water (kg in a m^3 mixture)',
       'Superplasticizer (kg in a m^3 mixture)',
       'Coarse Aggregate (kg in a m^3 mixture)',
       'Fine Aggregate (kg in a m^3 mixture)', 'Age (day)',
       'Concrete Compressive Strength(MPa, megapascals) '],
      dtype='object')
```

```
# define y
y=cement['Concrete Compressive Strength(MPa, megapascals) ']
```

```
# define X
x=cement[['Cement (kg in a m^3 mixture)',
          'Blast Furnace Slag (kg in a m^3 mixture)',
          'Fly Ash (kg in a m^3 mixture)','Water (kg in a m^3 mixture)',
          'Superplasticizer (kg in a m^3 mixture)',
          'Coarse Aggregate (kg in a m^3 mixture)',
          'Fine Aggregate (kg in a m^3 mixture)', 'Age (day)']]
```

```
# split data
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(x,y,random_state=2429)
```

```
# verify shape
x_train , x_test , y_train,y_test
```

```
    (      Cement (kg in a m^3 mixture)  Blast Furnace Slag (kg in a m^3 mixture)  \
     465                         173.81                                     93.37   
     709                         173.00                                    116.00   
     620                         254.00                                      0.00   
     1014                        132.00                                    206.50   
     877                         296.00                                      0.00   
     ...                            ...                                       ...   
     810                         310.00                                      0.00   
     669                         288.00                                    192.00   
     493                         387.00                                     20.00   
     367                         214.90                                     53.80   
     282                         251.37                                      0.00   

           Fly Ash (kg in a m^3 mixture)  Water (kg in a m^3 mixture)  \
     465                          159.90                       172.34   
     709                            0.00                       192.00   
     620                            0.00                       198.00   
     1014                         160.90                       178.90   
     877                          107.00                       221.00   
     ...                             ...                          ...   
     810                            0.00                       192.00   
     669                            0.00                       192.00   
     493                           94.00                       157.00   
     367                          121.89                       155.63   
     282                          118.27                       188.45   

           Superplasticizer (kg in a m^3 mixture)  \
     465                                     9.73   
     709                                     0.00   
     620                                     0.00   
     1014                                    5.50   
     877                                    11.00   
     ...                                      ...   
     810                                     0.00   
     669                                     0.00   
     493                                    11.61   
     367                                     9.61   
     282                                     6.35   

           Coarse Aggregate (kg in a m^3 mixture)  \
     465                                   1007.2   
     709                                    946.8   
     620                                    968.0   
     1014                                   866.9   
     877                                    819.0   
     ...                                      ...   
     810                                    970.0   
     669                                    932.0   
     493                                    938.0   
     367                                   1014.3   
     282                                   1028.4   

           Fine Aggregate (kg in a m^3 mixture)  Age (day)  
     465                                 746.60        100  
     709                                 856.80         90  
     620                                 863.00        365  
     1014                                735.60         28  
     877                                 778.00         28  
```

```
# select model
from sklearn.linear_model import LinearRegression
model=LinearRegression()
```

```
# train model
model.fit(x_train , y_train)
```

```
    LinearRegression()
```

```
# predict with model
y_pred=model.predict(x_test)
```

```
# model evaluation
from sklearn.metrics import mean_absolute_percentage_error
mean_absolute_percentage_error(y_test,y_pred)
```

```
    0.36647532400879607
```

```
# model MAE
from sklearn.metrics import mean_absolute_error
mean_absolute_error(y_test,y_pred)
```

```
    9.245416993285962
```

```
# model MAPE
from sklearn.metrics import mean_absolute_percentage_error
mean_absolute_percentage_error(y_test,y_pred)
```

```
    0.36647532400879607
```

```
# model MSE
from sklearn.metrics import mean_squared_error
mean_squared_error(y_test,y_pred)
```

```
    136.34567141807133
```