# Assignment#02_Polynomial Regression SVR

## Dataset Description:

The Concrete Compressive Strength dataset contains features related to different components of a concrete mix like the age of the concrete, fly ash and slag used, etc. It is used to predict the compressive strength in megapascals of the concrete. The dataset has been used for both Polynomial Regression and Support Vector Regression and the charts have been plotted for the same.

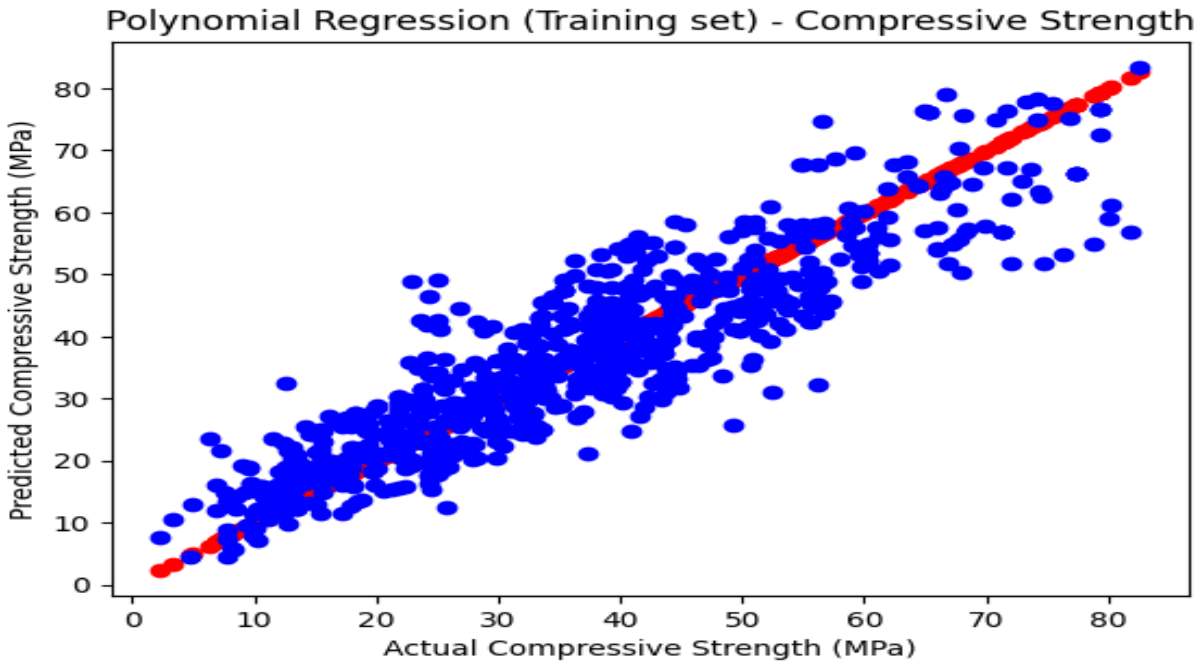
## Independent Variables/Features:

The independent variables used in this polynomial regression are:

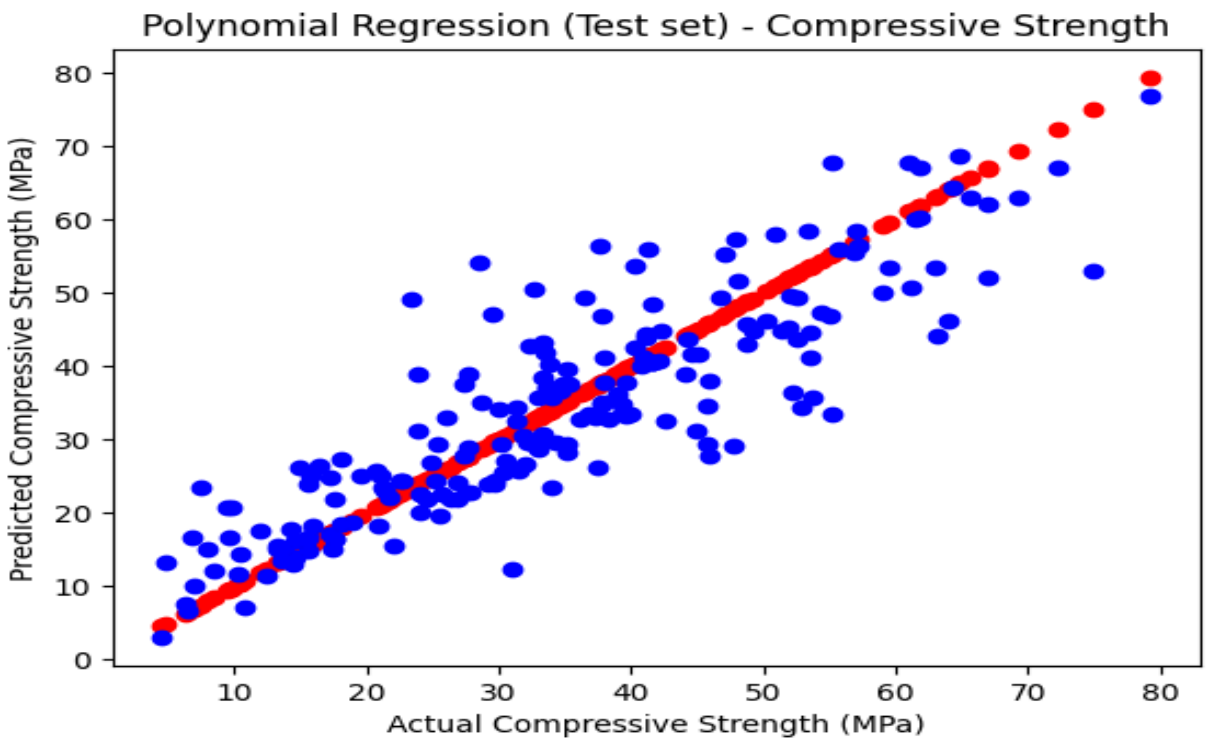
Cement, Blast Furnace Slag, Fly Ash, Water, Superplasticizer, Coarse Aggregate, Fine Aggregate and Age.

## Dependent/Output Variable:

Concrete Compressive Strength(CPS) in MPa




#Red dots are actual values and Blue dots are predicted values




In the Polynomial Regression model we used for this dataset, we applied a degree 2 polynomial (quadratic regression). Formula is as follows:

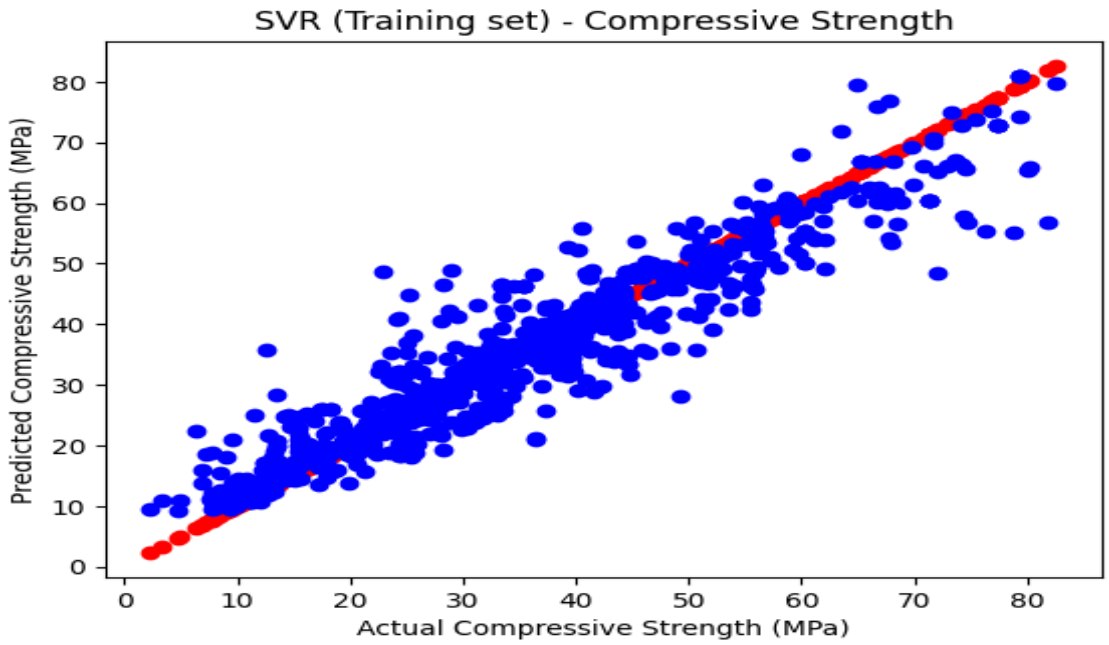
$y = \beta_0+\beta_1x_1+\beta_2x_2+\cdots+ \beta_nx_n+ \beta_{11}x_{12}+\beta_{12}x_1x_2+\cdots+\beta_{nn}x_n^2$

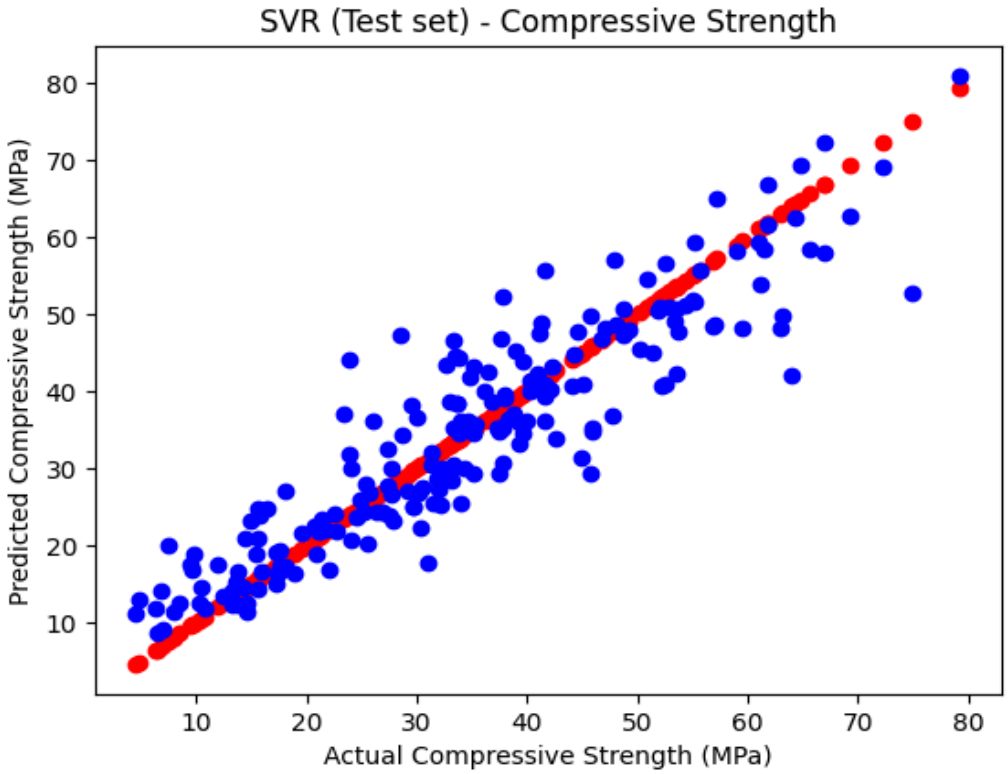
Where:

- y is the predicted Concrete Compressive Strength.
- $x_1,x_2,\ldots,xn$ are the independent variables (features)
- $B_0,\beta_1\ldots$ are the coefficients (weights) determined by the model.

Dataset Link: https://archive.ics.uci.edu/dataset/165/concrete+compressive+strength

Charts for support vector regression(SVR):



The Support vector regression prediction formula is as follows:

$y = \Sigma (\alpha_i * K(x, x_i)) + b$

Where:

- y is the predicted output.
- x is the input vector
- $K(x, x_i)$ is the Radial Basis Function (RBF) kernel
- $\alpha_i$ are the learned coefficients for each support vector.
- b is the model bias term.

Prediction of values:

| CementComponent | BlastFurnace | FlyAsh | Water | SuperPlasticizer | CoarseAggregate | FineAggregate | Age | PolynomialReg_Predicted_CPS | SVR_Predicted_CPS |
|---|---|---|---|---|---|---|---|---|---|
| 300 | 150 | 50 | 180 | 10 | 1000 | 700 | 100 | 72.37 | 71.25 |