ELL409 – Assignment:3 Report

Support Vector Regression

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Code Explanation:

File SVR: Implemenation of SVR using cvxopt

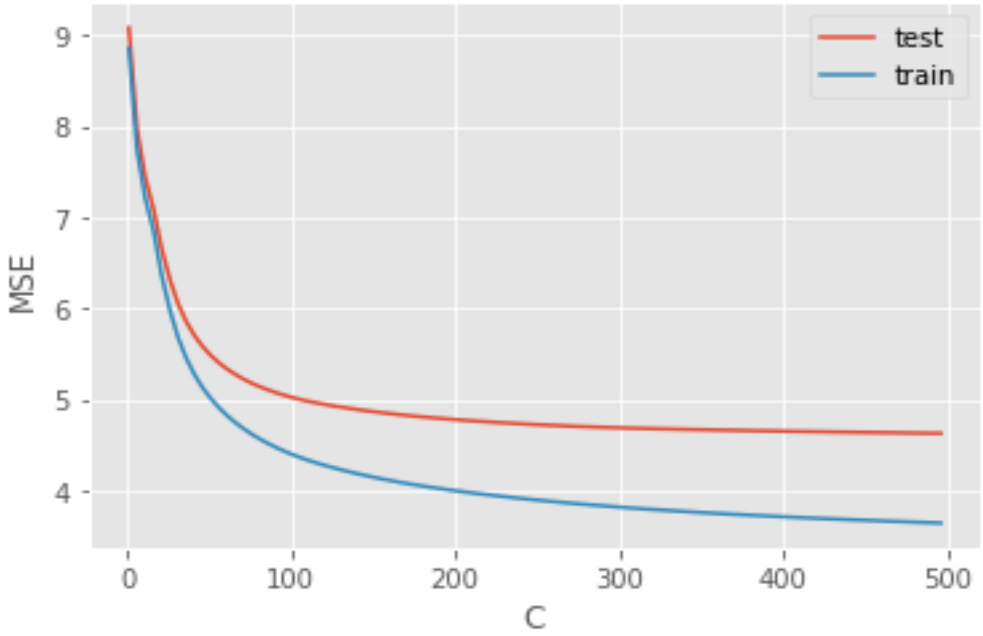
- Converted the given dataset into the csv file. (csv file is included in submission folder)
- Scaled the X data so it is 0 centred and unit variance
- Method: Cross validation split :It takes X and y as input and returns lists X_split and y_split, containing k arrays in which the data is divided.
- Defined different types of kernels: linear, polynomial, gaussian
- Method: getG: It takes number of examples and C as input and returns constrain matrix (G) required for the cvxopt solver
- Method: optimize: It returns the value of all langragian parameters (alpha & alpha') and b _star(optimal b) For cvxopt considered the variables to be all $alpha_i$ and $–(alpha'_i)$
- Method: find_mse: It return the r2 score of the data
- Method: find_mse: It returns the root mean square error
- Method: test_function: It finds the y_pred and returns mse and r2_score for both test data and train data
- Found the r2scores and mse values of k no of iteration and reported their mean values (k is no of folds for kfold cross validation)

In the svr_sklearn file, svr has been implemented using the sklearn.svr using the kfold cross validation.

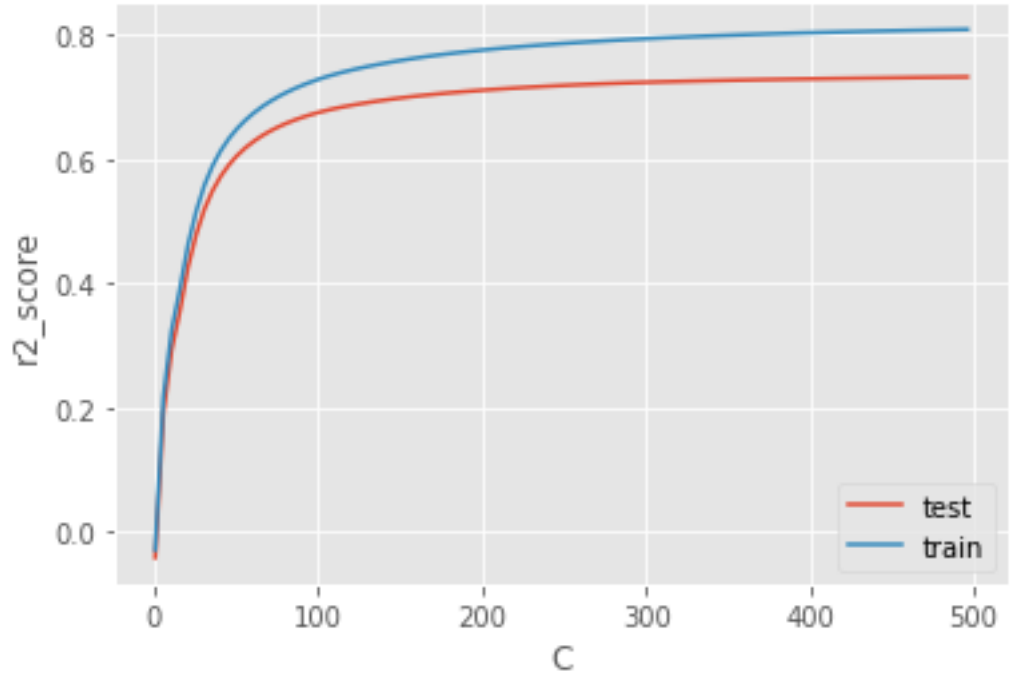
Results:

Hyperparameter-variation in own implementation: (for gaussian kernel)

1. Variation of C (keeping epsilon fixed, = 0.1)

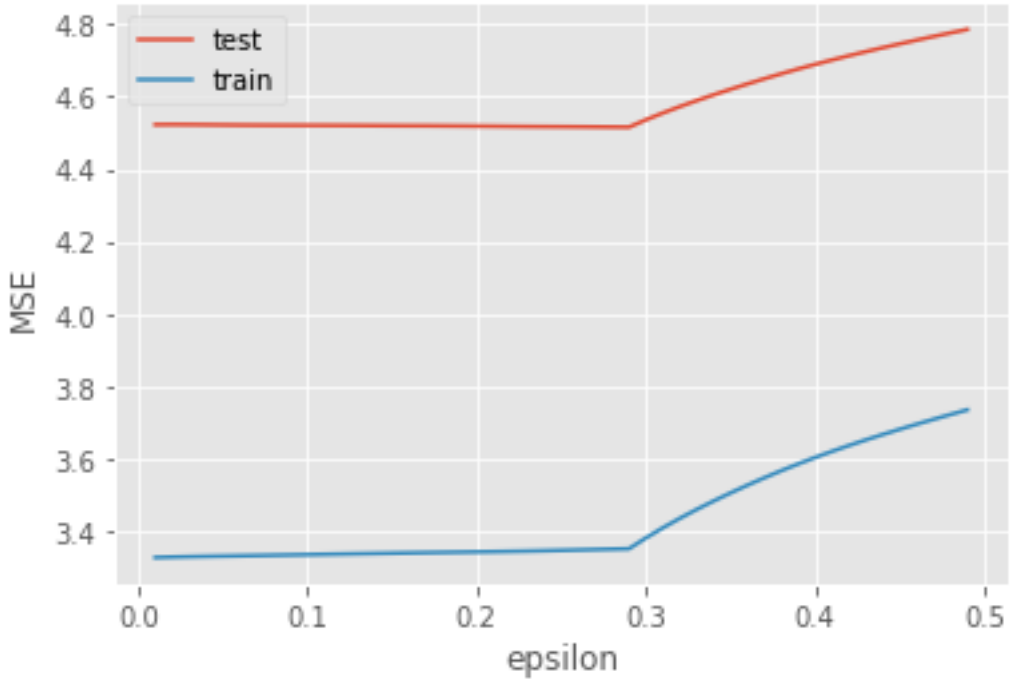


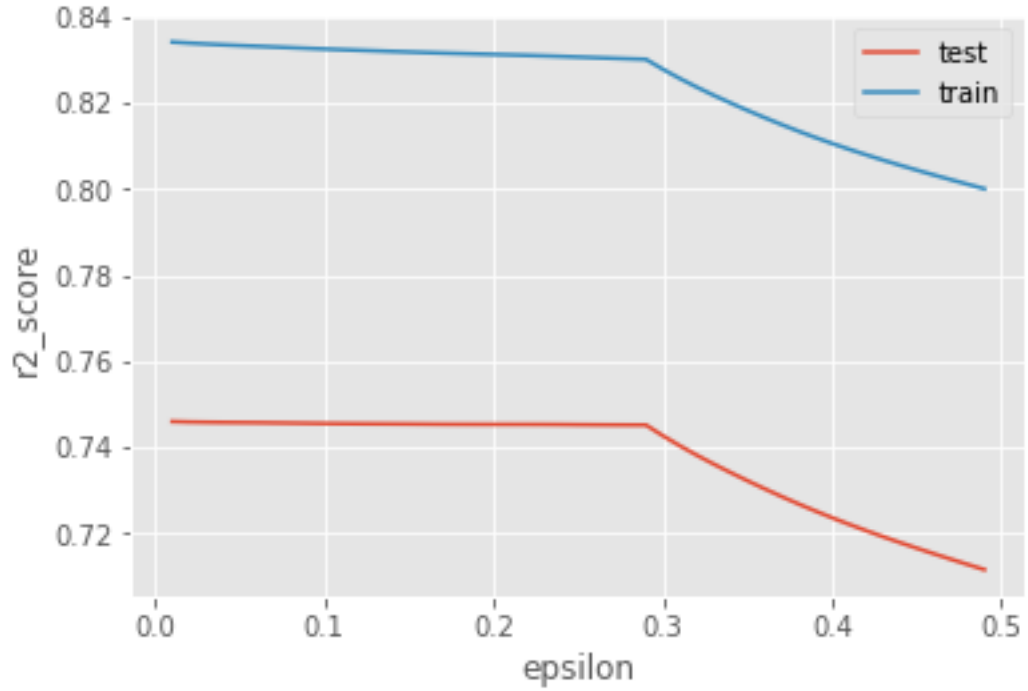
MSE value shown is root mean square error



The test error and accuracy both are almost constant after C crosses the value around 300. Around C =500 the change in test error is in 4th decimal. Hence took the value of C=500

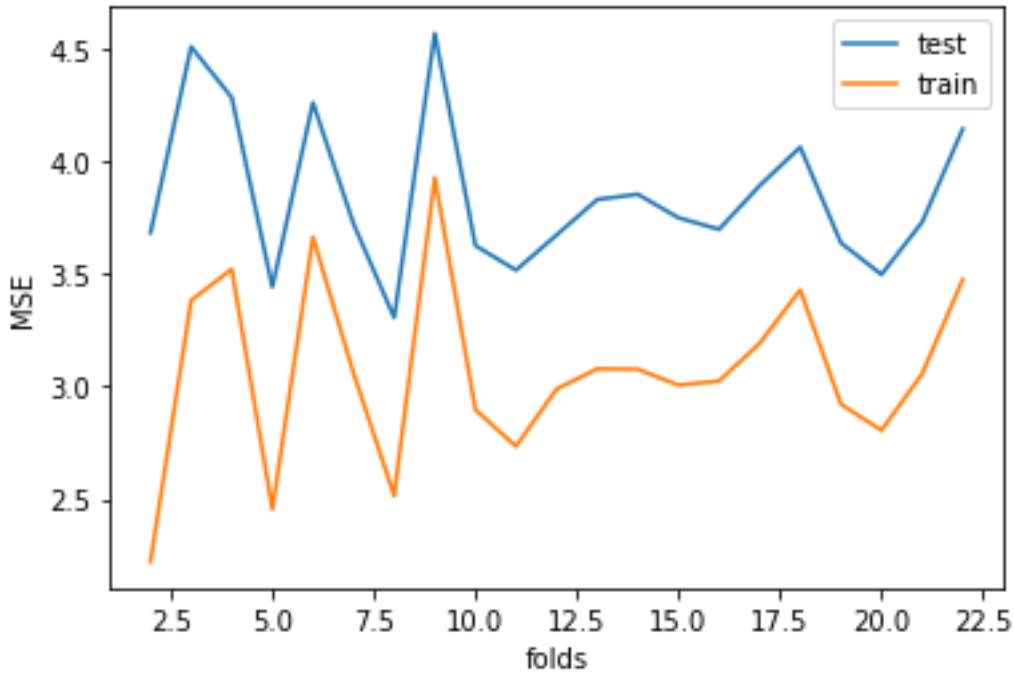
2. Variation of epsilon (keeping C fixed, = 500)

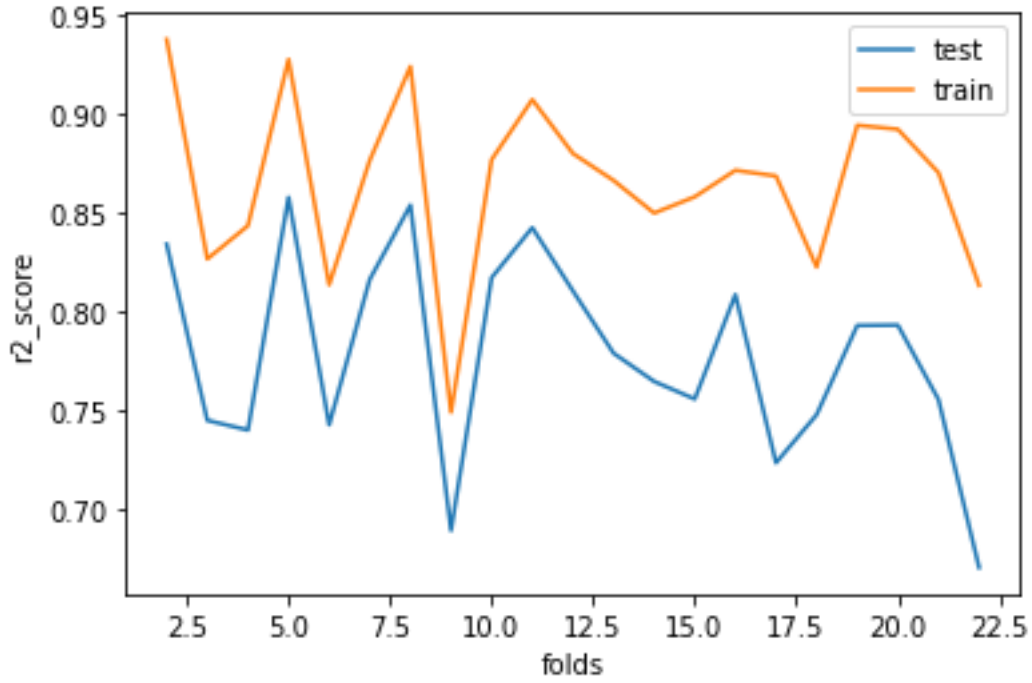




The optimal value of epsilon found to be 0.29, after which it it showing overfitiing.

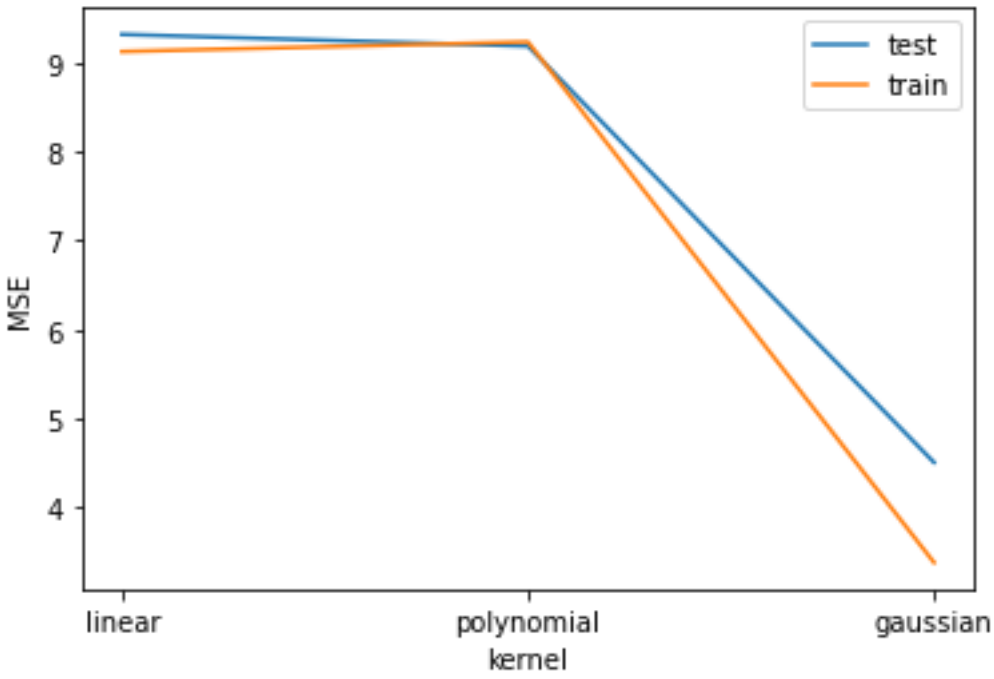
3. Variation of # folds (k) (keeping C = 500, epsilon = 0.29)





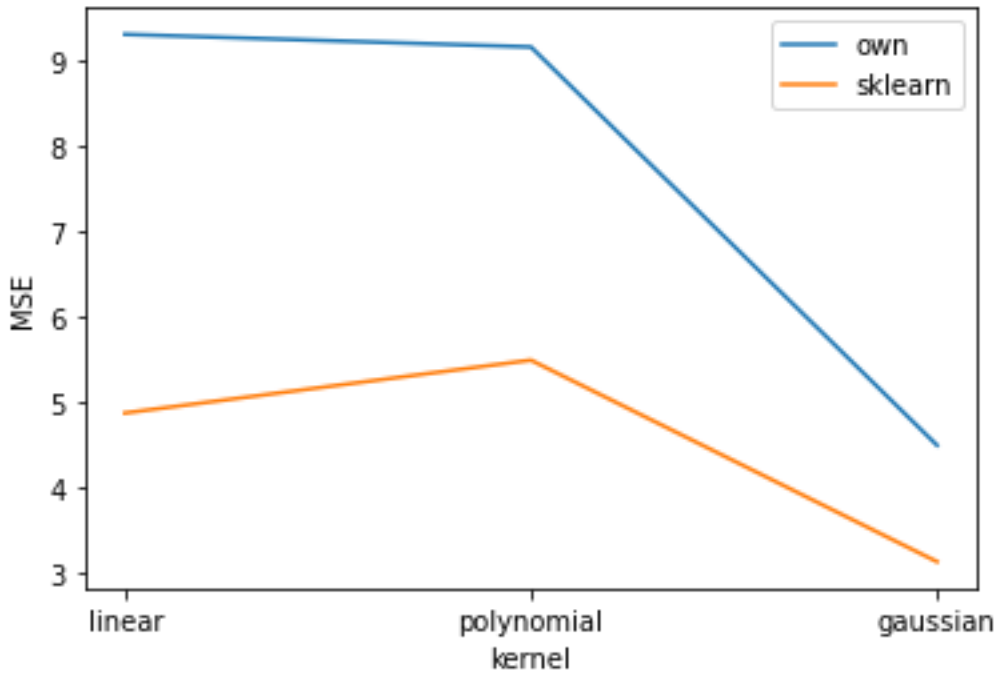
For different types of kernels:

Kernel type	Optimal C	Optimal epsilon	MSE
Linear	1	0.01	9.3148
Polynomial (p=3)	11	0.35	9.1672
Gaussian	500	0.29	4.5059



Hence the best performing is gaussian kernel in our implementation

Comparison with Sklearn SVR:



For all types of kernels, svr sklearn performs significantly better from the implementation.