Assignment 3 - Machine Learning
Problem 6c and 6d

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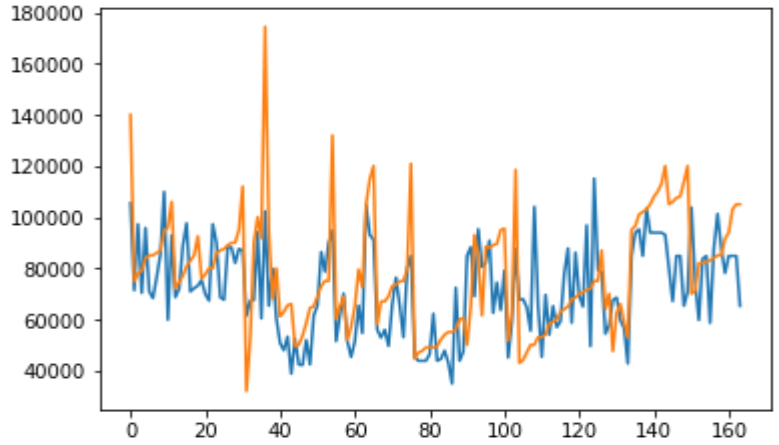
Problem 6c:- Linear Regression Prediction model using batch and stochastic gradient descent and their comparison with and without regularization.

Series of linear rates taken:-

```
[0.01,0.05,0.1,0.15]
```

https://colab.research.google.com/drive/1tiyQytlipIYTr_SITmIvpFnqBSsAk05P?usp=sharing

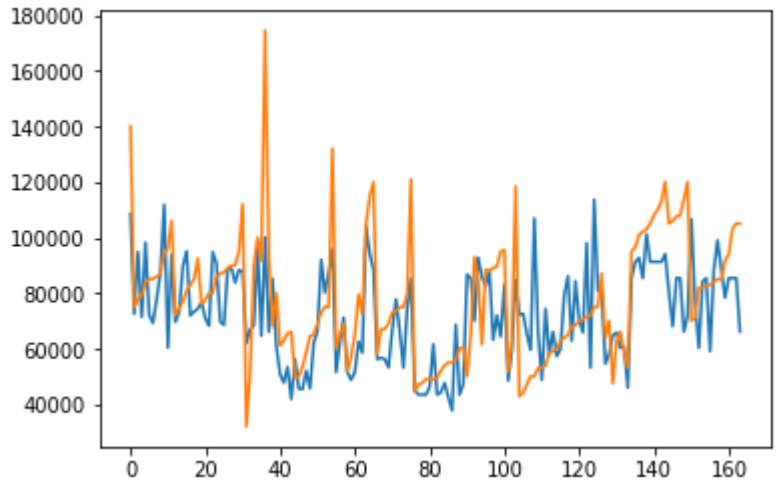
1.
Regularization = NO
Optimization = Batch GDA
Learning rate = 0.01



Result :-

```
Percentage error:- 4.855088540791764
Percentage Accuracy:- 95.14491145920823
```

2.
Regularization = NO
Optimization = Batch GDA
Learning rate = 0.05



Result :-

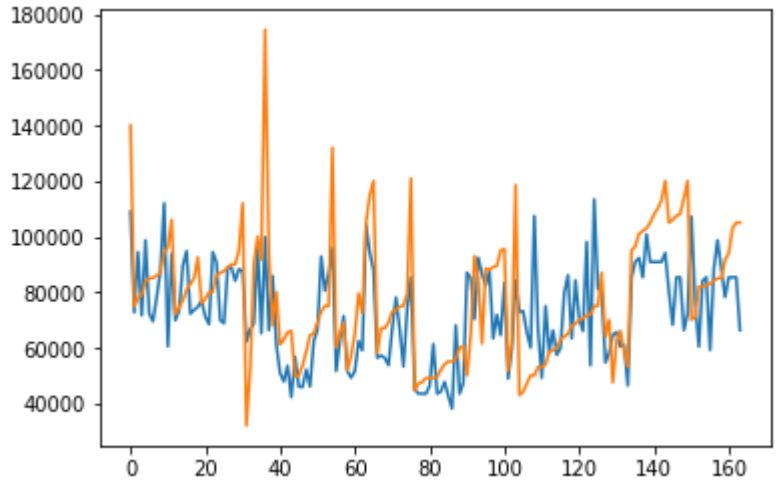
```
Percentage error:- 3.7091790831894658
Percentage Accuracy:- 96.29082091681053
```

3.

Regularization = NO

Optimization = Batch GDA

Learning rate = 0.1



Result:-

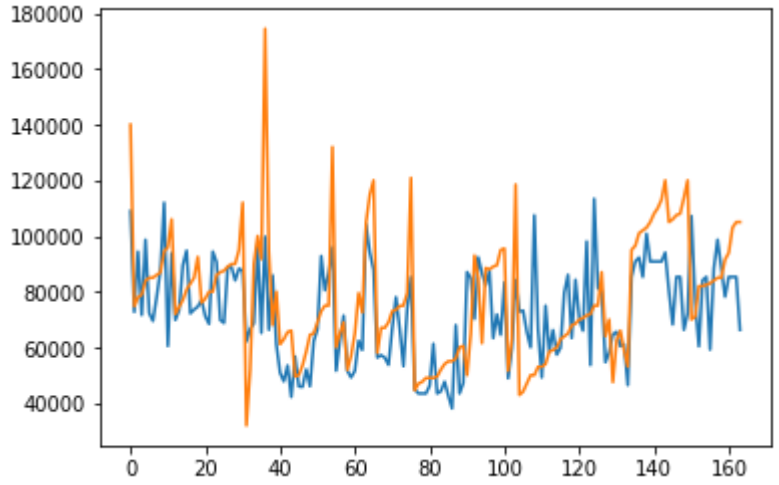
```
Percentage error:- 3.537776828561487
Percentage Accuracy:- 96.46222317143851
```

4.

Regularization = NO

Optimization = Batch GDA

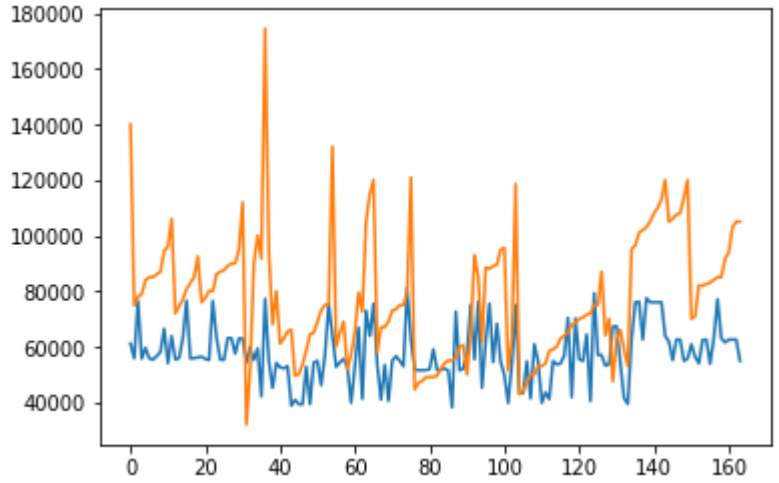
Learning rate = 0.15



Percentage error:- 3.532410437136341
Percentage Accuracy:- 96.46758956286367

5.(Stochastic GDA)

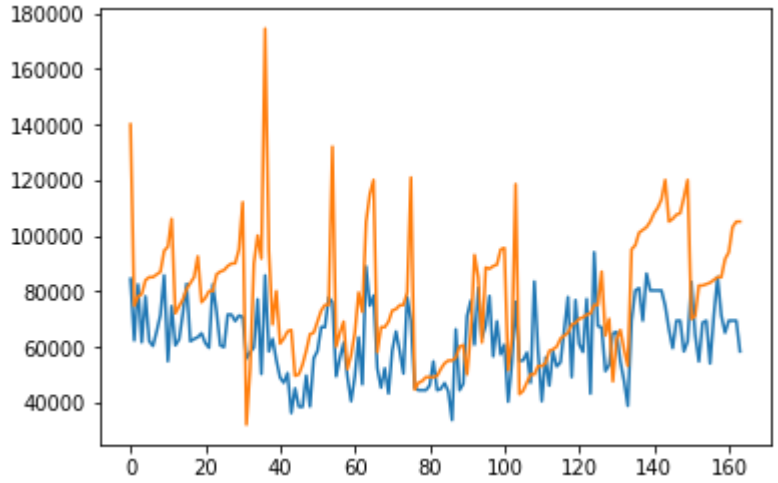
Regularization = NO
Optimization = SGDA
Learning rate = 0.01



Percentage error:- 22.21293905673595
Percentage Accuracy:- 77.78706094326405

6.

Regularization = NO
Optimization = SGDA
Learning rate = 0.05



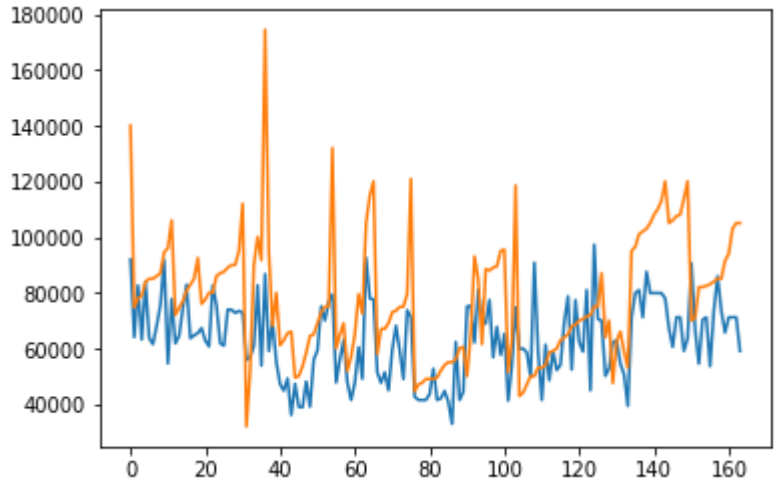

```
Percentage error:- 16.948438095708195
Percentage Accuracy:- 83.0515619042918
```

7.

Regularization = NO

Optimization = SGDA

Learning rate = 0.1



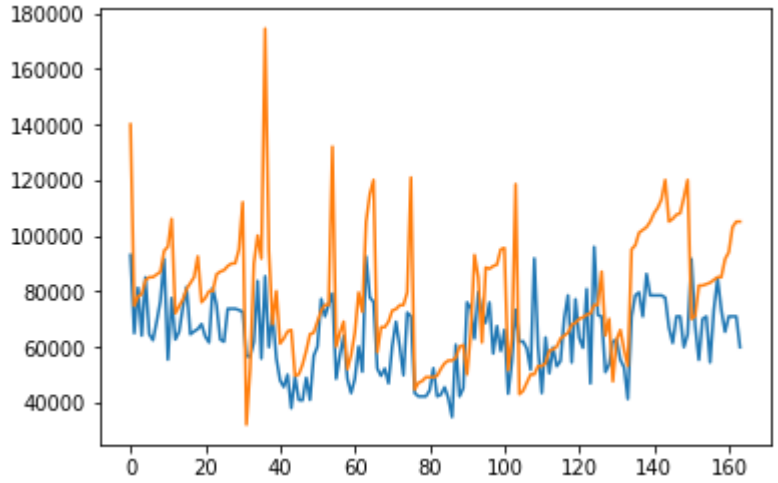

```
Percentage error:- 15.702344765378756
Percentage Accuracy:- 84.29765523462125
```

8.

Regularization = NO

Optimization = SGDA

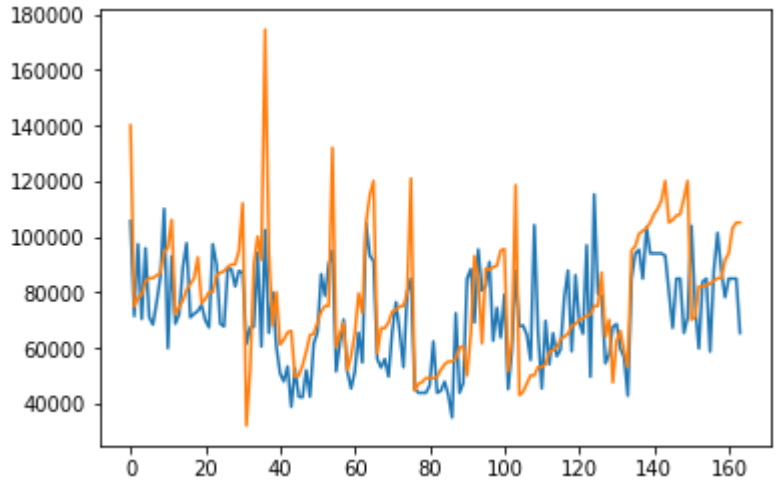
Learning rate = 0.15



Percentage error:- 14.914700876071027
Percentage Accuracy:- 85.08529912392898

9.(Batch GDA + L2 lamda = 0.5)

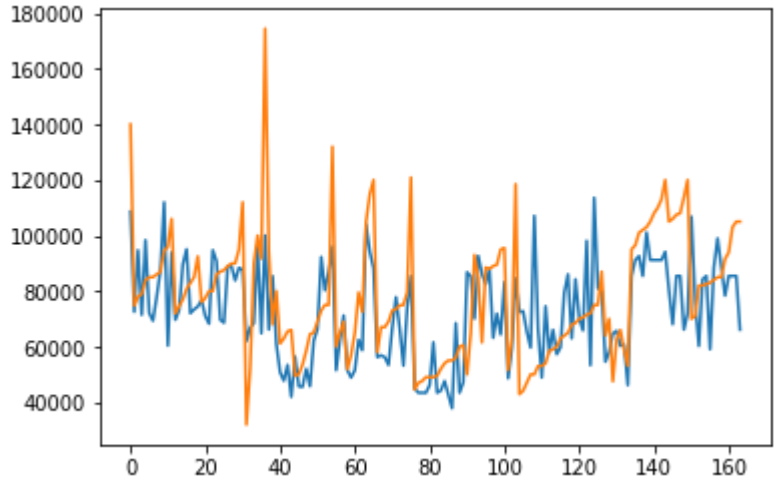
Regularization = yes(L2)
Optimization = Batch GDA
Learning rate = 0.01



Percentage error:- 4.833110694353152
Percentage Accuracy:- 95.16688930564685

10.

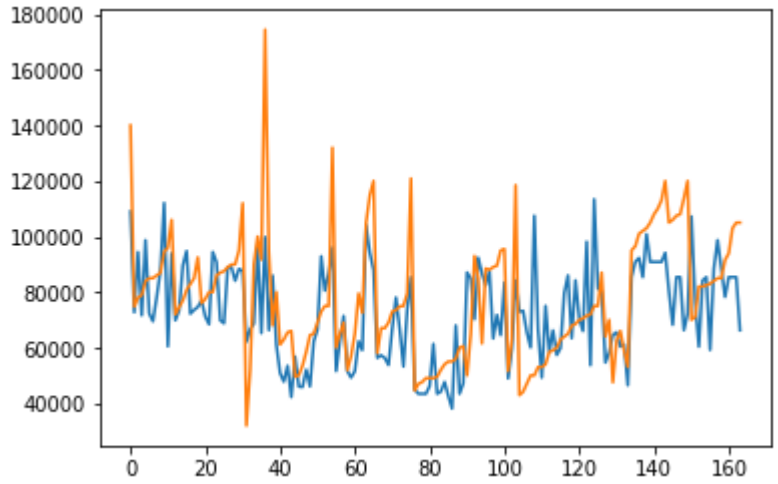
Regularization = yes(L2)
Optimization = GDA
Learning rate = 0.05



Percentage error:- 3.6493960110780503
Percentage Accuracy:- 96.35060398892195

11.

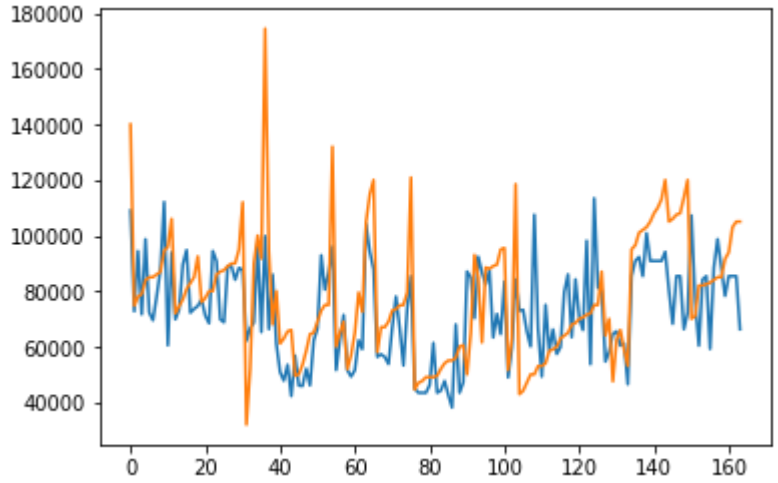
Regularization = yes(L2)
Optimization = GDA
Learning rate = 0.1



Percentage error:- 3.5124189813148265
Percentage Accuracy:- 96.48758101868518

12.

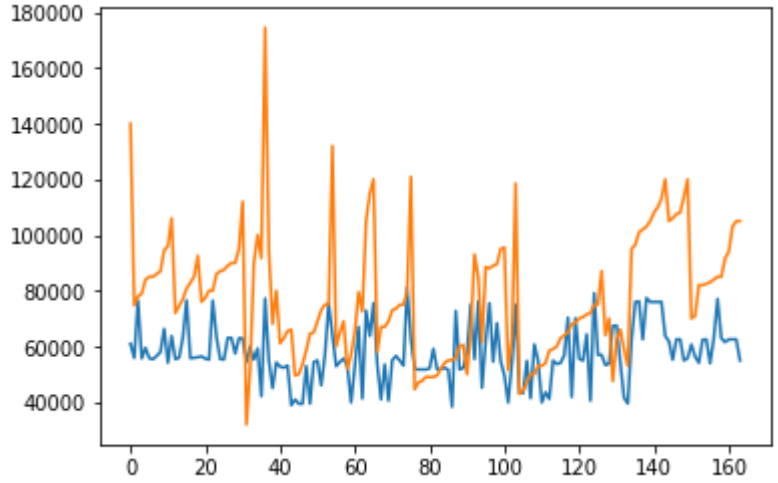
Regularization = yes(L2)
Optimization = GDA
Learning rate = 0.15



Percentage error:- 3.511450534501137
Percentage Accuracy:- 96.48854946549886

13.(Stochastic GDA + L2 lamda = 0.5)

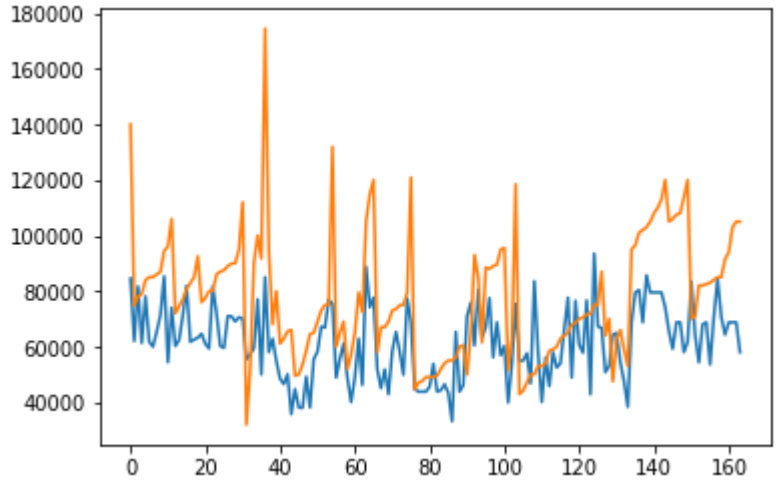
Regularization = yes(L2)
Optimization = SGDA
Learning rate = 0.01



Percentage error:- 22.158172783561184
Percentage Accuracy:- 77.84182721643882

14.

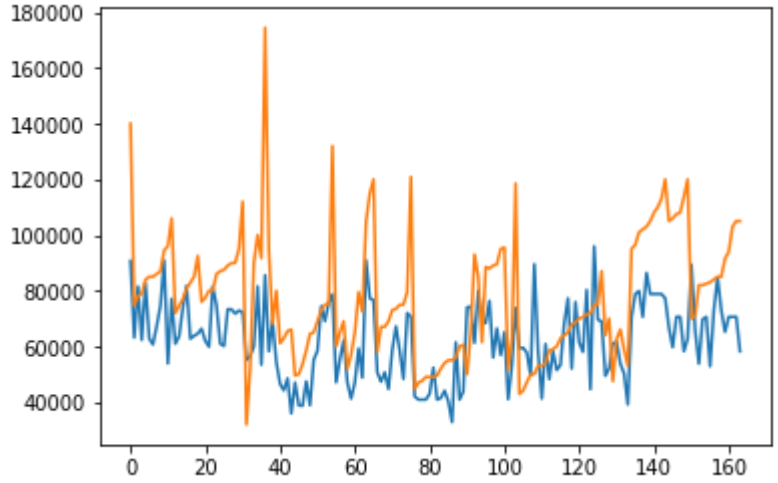
Regularization = yes(L2)
Optimization = SGDA
Learning rate = 0.05



Percentage error:- 17.474364010679583
Percentage Accuracy:- 82.52563598932042

15.

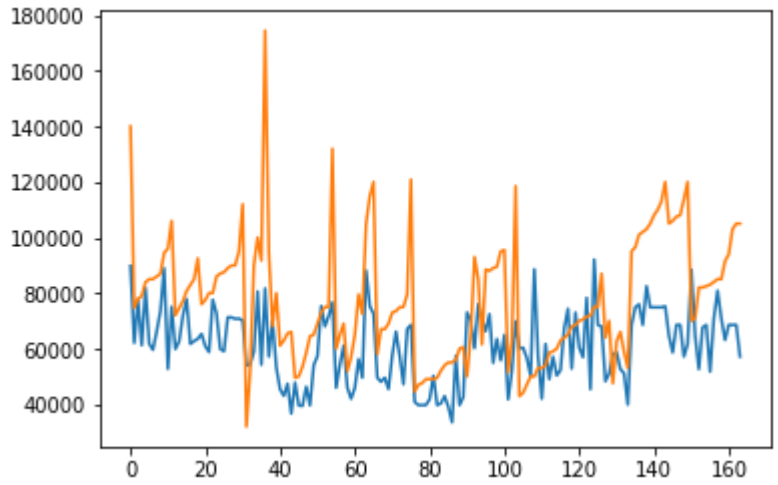
Regularization = yes(L2)
Optimization = SGDA
Learning rate = 0.1



Percentage error:- 16.70130987401495
Percentage Accuracy:- 83.29869012598505

16.

Regularization = yes(L2)
Optimization = SGDA
Learning rate = 0.15

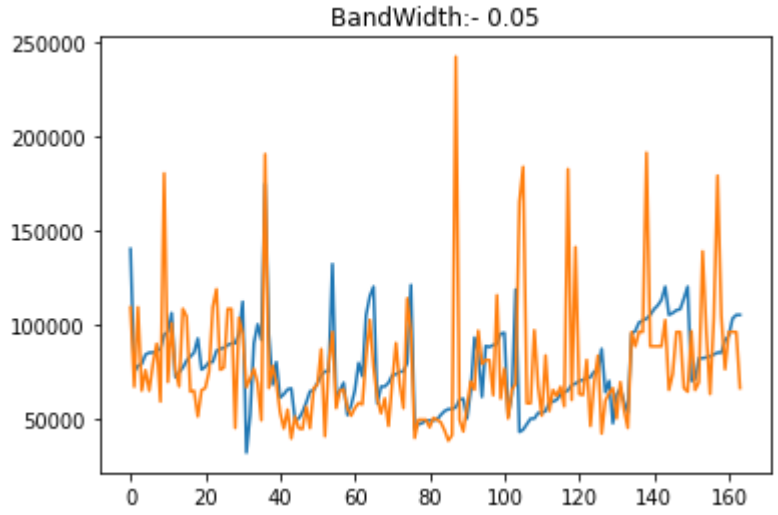



```
Percentage error:- 18.441335324034082
Percentage Accuracy:- 81.55866467596591
```

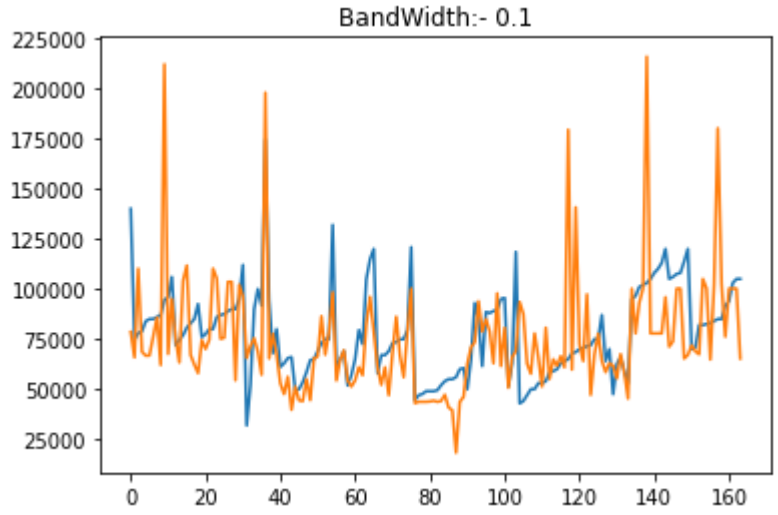
6 D. Implementing LWR with different bandwidth,finding most suitable among them and comparing with LR.

```
bandwidths = [0.05,0.10,0.15,0.5,1,1.5]
```

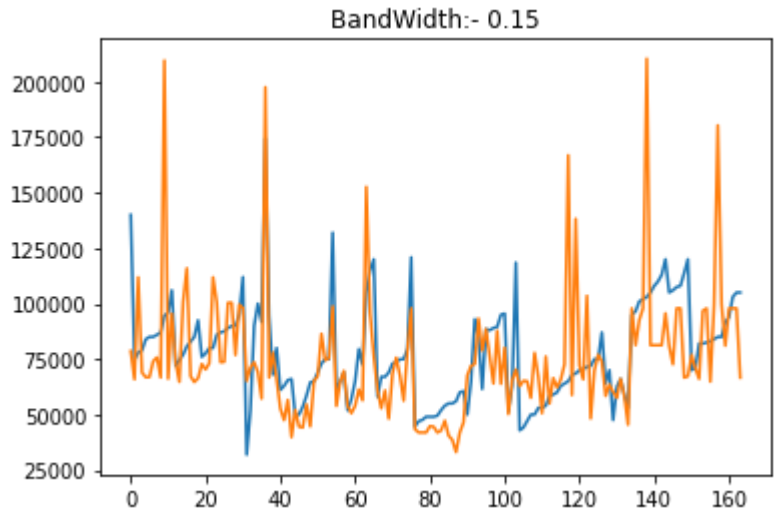
https://colab.research.google.com/drive/1ZT32-atV7_ukePlqIABRt2hSEoHegge3?usp=sharing



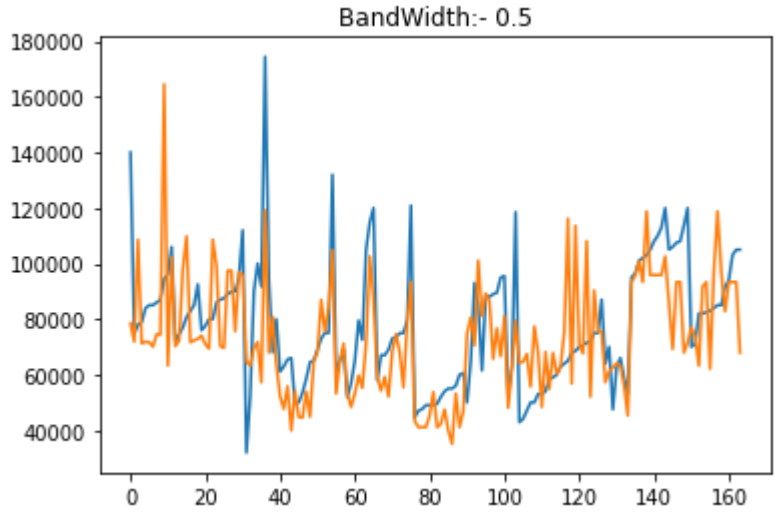
Percentage error:- 3.9185725269811913
Percentage Accuracy:- 96.0814274730188



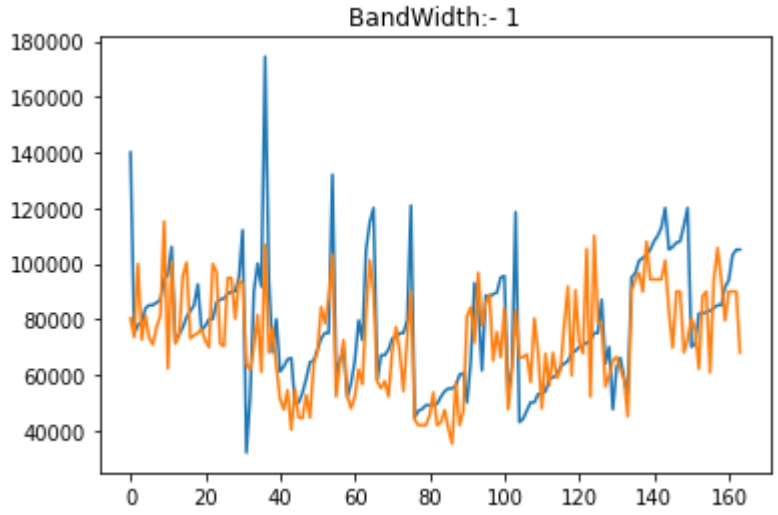
Percentage error:- 1.491950283928859
Percentage Accuracy:- 98.50804971607114



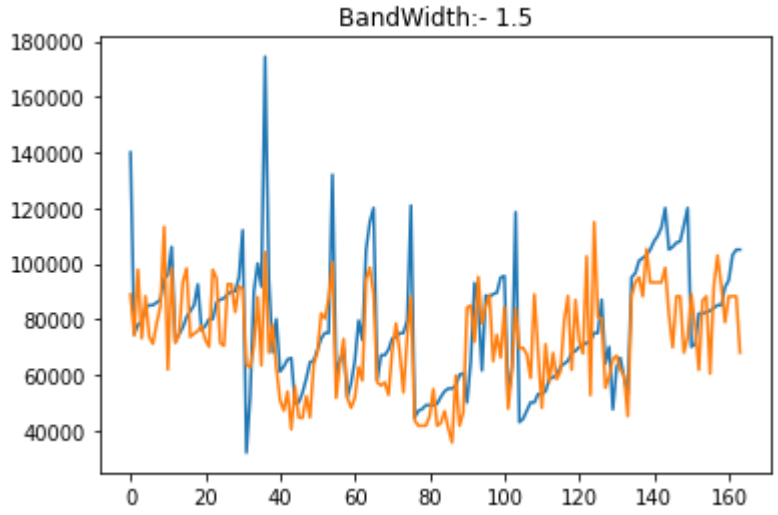
Percentage error:- 1.6806143386501864
Percentage Accuracy:- 98.31938566134981



Percentage error:- 3.383755451776766
Percentage Accuracy:- 96.61624454822324



Percentage error:- 4.17141778655933
Percentage Accuracy:- 95.82858221344067



Percentage error:- 3.849984586746533
Percentage Accuracy:- 96.15001541325347

```
Best bandwidth = 0.1
Loss in that = 1.49 %
Accuracy = 98.5 %

Comparing with Linear Regression
Without regularization and Batch GDA
Best case:-
Percentage error:- 3.532410437136341
Percentage Accuracy:- 96.46758956286367
```

Without regularization and SGDA
Best case:-
Percentage error:- 14.914700876071027
Percentage Accuracy:- 85.08529912392898

With regularization and Batch GDA
Best Case:-
Percentage error:- 3.511450534501137
Percentage Accuracy:- 96.48854946549886

With regularization and SGDA
Best case:-
Percentage error:- 16.70130987401495
Percentage Accuracy:- 83.29869012598505

Therefore,LWR outperforms LR in this database case