Assignment 2 - report - Machine Learning

Questions 6c, 6d

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Google Colab Link for Code

Question 6c -
https://colab.research.google.com/drive/1ateYCXymsHwvQFWauyQZcl6m_kjs6znL?usp=sharing

Question 6d -
https://colab.research.google.com/drive/1pPzQ0jsLlQPT-7aXEpeVHaG7T5OwoKVW?usp=sharing

Question 6c

Design Predictor using Batch Gradient Descent Algorithm, Stochastic Gradient Algorithm and mini batch Gradient Descent algorithms (determining minibatch size is your choice- here it could be 10, 20, 30 etc.) with and without regularization and compare their performances in terms of % error in prediction.

Question 6c results

Batch Gradient without Regularization

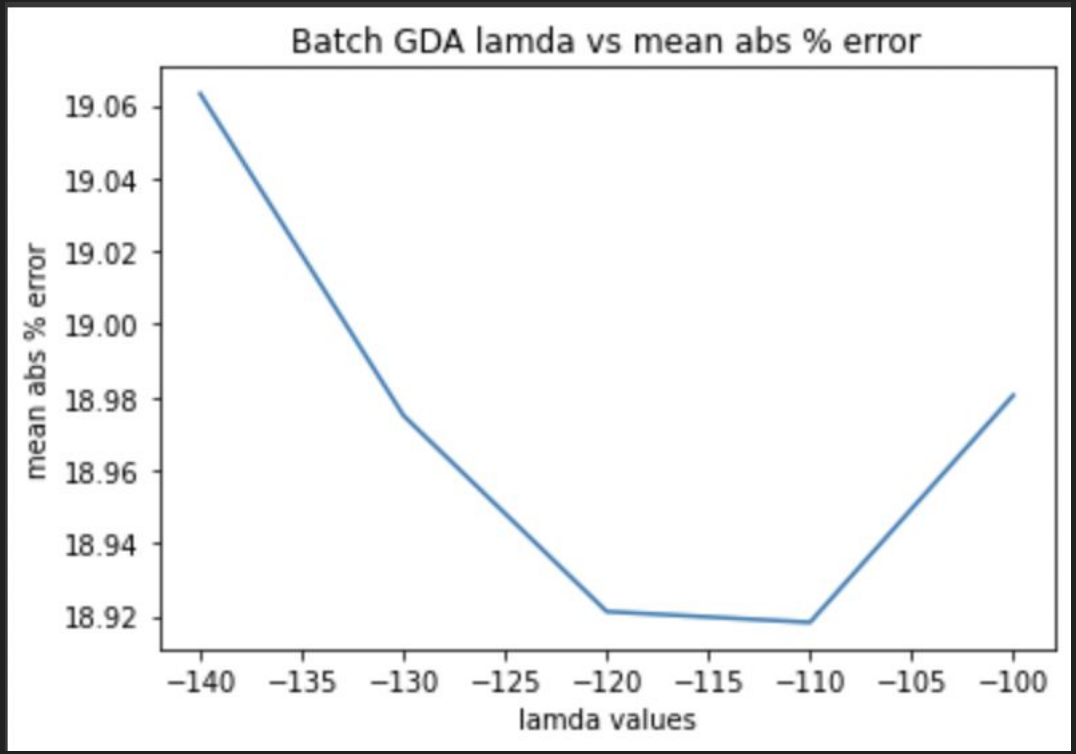
- Mean Absolute Error: 20.342942821184607%
- Learning Rate = 0.001

Batch gradient with regularisation

- Mean Absolute Error: 18.921248165226 27%
- Learning Rate = 0.001
- Lambda = -120

OBSERVATION: We observe there is a decrease in Mean Absolute error after using Regularization in Batch GDA Algorithm

Mean error for Different values of Lambda



Question 6c results

Stochastic gradient without regularisation

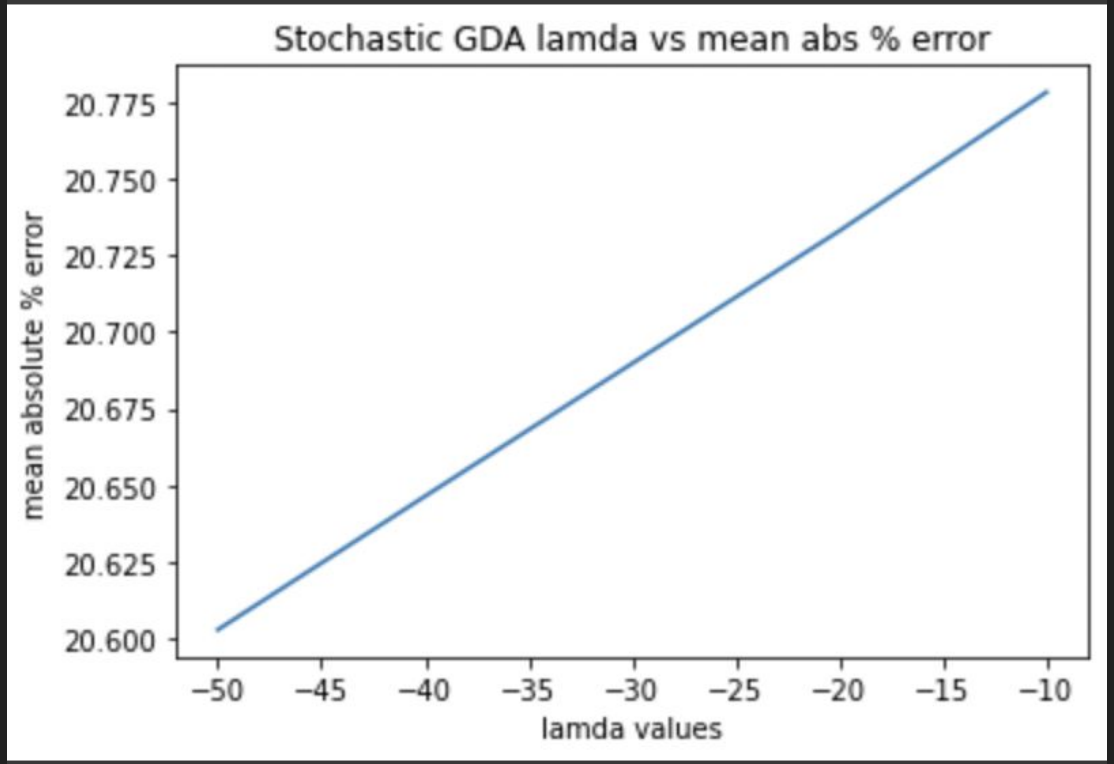
- Mean Absolute Error: 19.4235264364387 67%
- Learning Rate = 0.0005

Stochastic gradient with regularisation

- Mean Absolute Error: 19.299850024980504%
- Learning Rate = 0.0005
- Lambda = -30

OBSERVATION: We observe there is a slight decrease in Mean Absolute error after using Regularization for Stochastic GDA

Mean error for Different values of Lambda



Question 6c results

Mini-batch gradient without regularisation

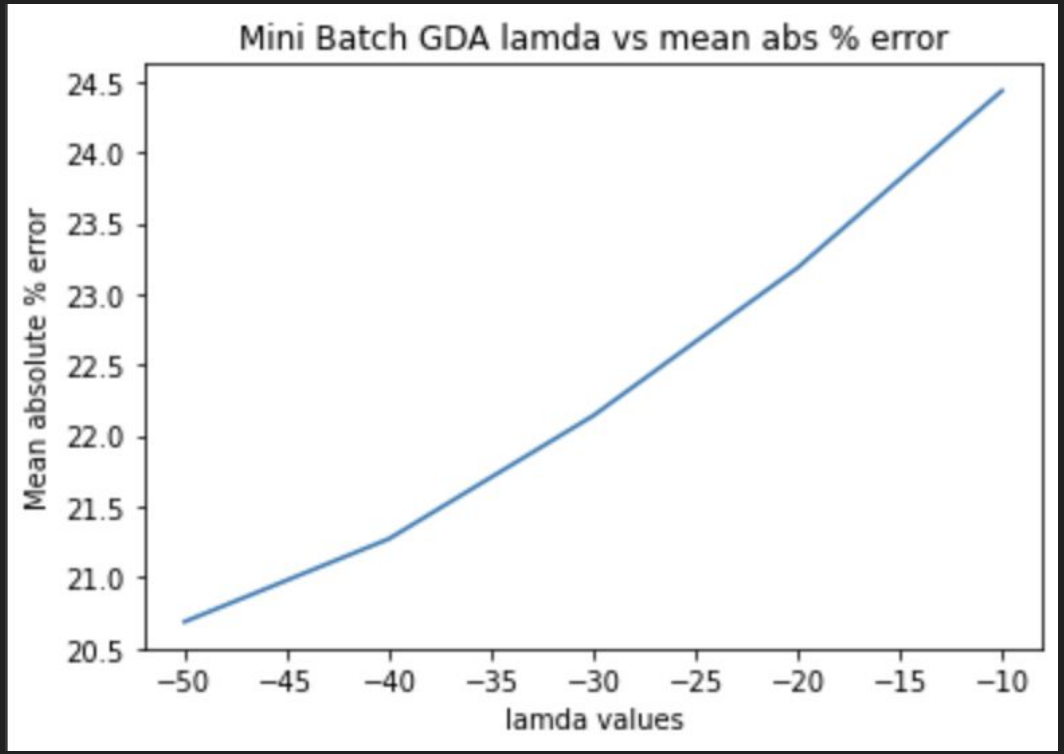
- Absolute Mean Error: 25.794843431025104%
- BatchSize = 20;
- Learning Rate = 0.0002

Mini-batch gradient with regularisation

- Absolute Mean Error: 23.185650124145248%
- BatchSize = 20;
- Learning Rate = 0.0002
- Lambda = -20

OBSERVATION: We observe there is a decrease in Mean Absolute error after using Regularization for Mini Batch GDA

Mean error for Different values of Lambda



Question 6d

Implement the LWR algorithm on the Housing Price data set with different tau values. Find out the tau value which will provide the best fit predictor and hence compare its results.

Question 6d results

- **Applying LWR for many different values of Tau**
- **Different value of Tau used**

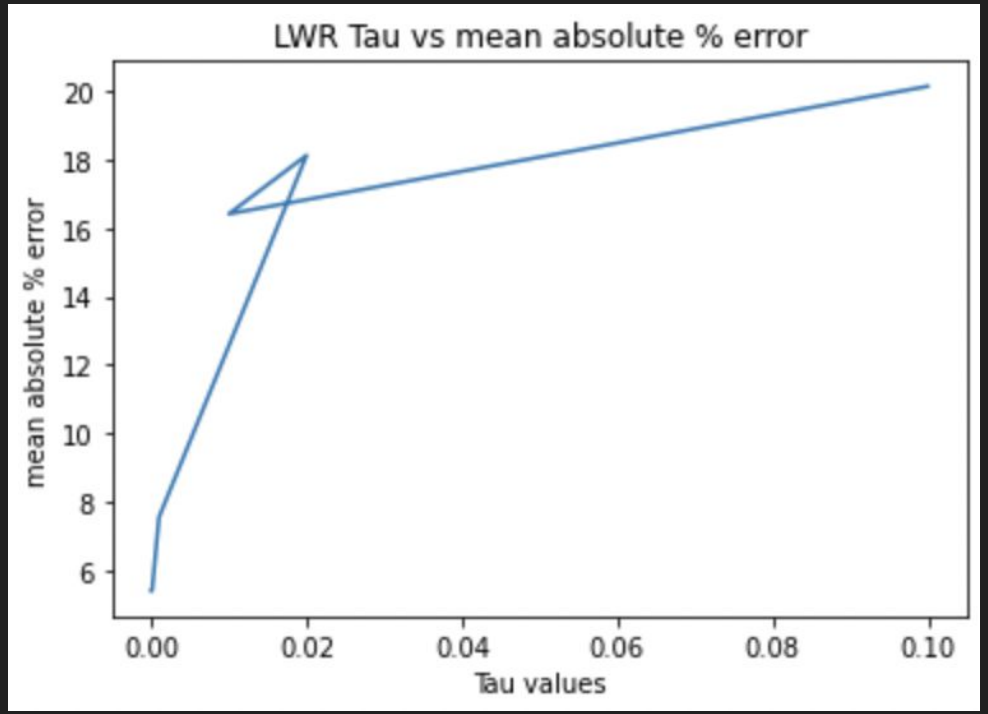
  `[0.1, 0.01, 0.02, 0.001, 0.0001, 0.00001]`

- `Mean absolute percentage error for Tau = 0.1 is : [20.14065581]`
- `Mean absolute percentage error for Tau = 0.01 is :  [16.41583941]`
- `Mean absolute percentage error for Tau = 0.02 is :  [18.12596846]`
- `Mean absolute percentage error for Tau = 0.001 is :  [7.56066413]`
- `Mean absolute percentage error for Tau = 0.0001 is :  [5.40856556]`
- `Mean absolute percentage error for Tau = 0.00001 is :  [5.40730554]`

Observation: Here we observe that as we increased the value of Tau from 0.1 the Absolute error starts decreasing

We also observe that for Tau=0.00001 we get the Error as 5.40% which is minimum among all the previous algorithms used

Mean error for Different values of Tau



Conclusion

We can conclude that regularizing the GDA algorithms helps in reducing the error in case of high bias or variance circumstances

We observe that LWR with lower value of Tau(~0.00001) gives the minimum error among all the other algorithms described.