Machine Learning Assignment

(Linear regression and gradient descent)

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Section: B

Terminal Outputs and Plots (Simple)

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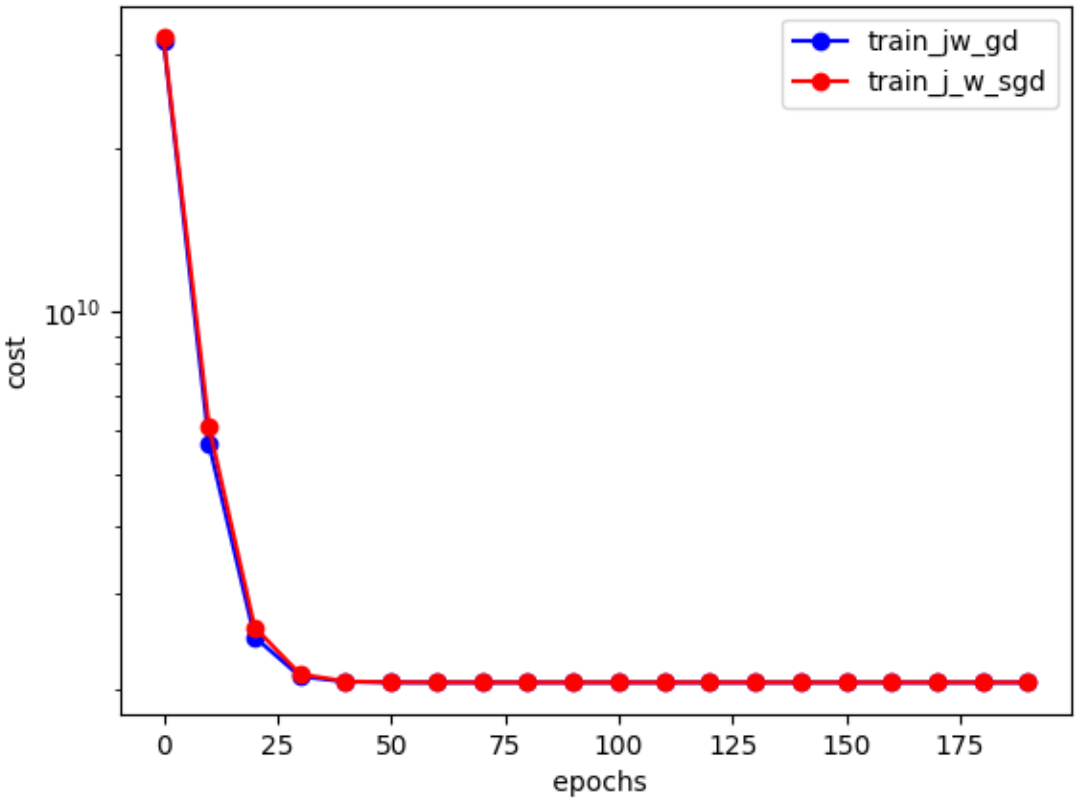
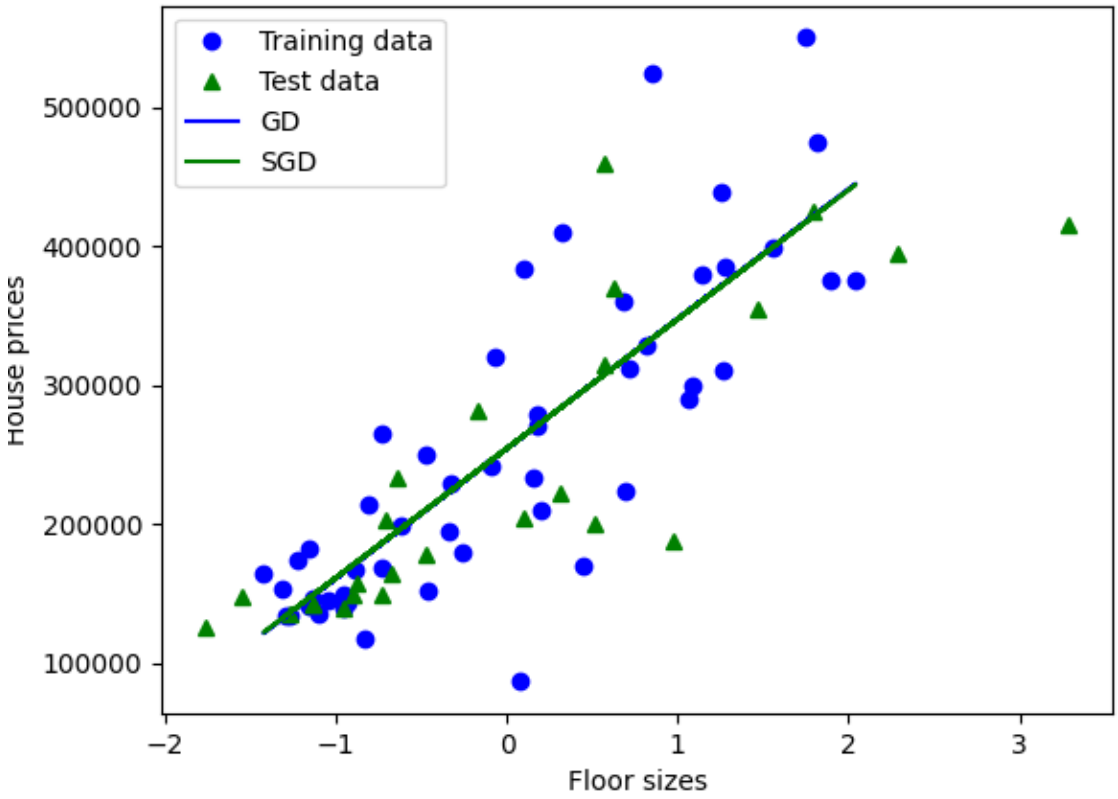
PROBLEMS  OUTPUT  TERMINAL  PORTS  POSTMAN CONSOLE  SEARCH ERROR  DEBUG CONSOLE

python -u "/Users/ferdoussazid/Downloads/linear_regression/code/simple.py"
(base) ferdoussazid@Ferdouss-MacBook-Pro linear_regression % python -u "/Users/ferdoussazid/Downloads/linear_regression/code/simple.py"
Params GD:  [254449.99982048  93308.92004027]
Params SGD:  [254550.06767351  92946.32643744]
Training RMSE: 64083.51.
Training cost: 2053348364.32.
Test RMSE: 65773.19.
Test cost: 2163056350.22.
Training RMSE SGD: 64084.62.
Training cost SGD: 2053419108.17.
Test RMSE SGD: 2152656638.19.
Test cost SGD: 2152656638.19.
(base) ferdoussazid@Ferdouss-MacBook-Pro linear_regression %

ink  Explain Code  Comment Code  Find Bugs  Code Chat  Search Error   Ln 1, Col 1  Spaces: 2  UTF-8  LF  Python  3.11.1 64-bit
```





Terminal Outputs and Plots (Multiply)

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PROBLEMS  OUTPUT  TERMINAL  PORTS  POSTMAN CONSOLE  SEARCH ERROR  DEBUG CONSOLE

/Users/ferdoussazid/.pyenv/versions/3.11.1/bin/python /Users/ferdoussazid/Downloads/linear_regression/code/multiple.py
(base) ferdoussazid@Ferdouss-MacBook-Pro linear_regression % /Users/ferdoussazid/.pyenv/versions/3.11.1/bin/python /Users/ferdoussazid/Down
Params GD:  [254449.99982048  78079.18106675  24442.5758378   2075.95636731]
Params SGD:  [254580.71771403  77853.15388901  24170.61766679  1508.27966708]
Training RMSE: 61070.62.
Training cost: 1864810304.94.
Test RMSE: 58473.59.
Test cost: 1709580288.69.
Training RMSE SGD: 61075.13.
Training cost SGD: 1865085468.61.
Test RMSE SGD: 1695241650.30.
Test cost SGD: 1695241650.30.
(base) ferdoussazid@Ferdouss-MacBook-Pro linear_regression %

ink  Explain Code  Comment Code  Find Bugs  Code Chat  Search Error   Ln 1, Col 1  Spaces: 2  UTF-8  LF  Python  3.11.1 64-bit
```

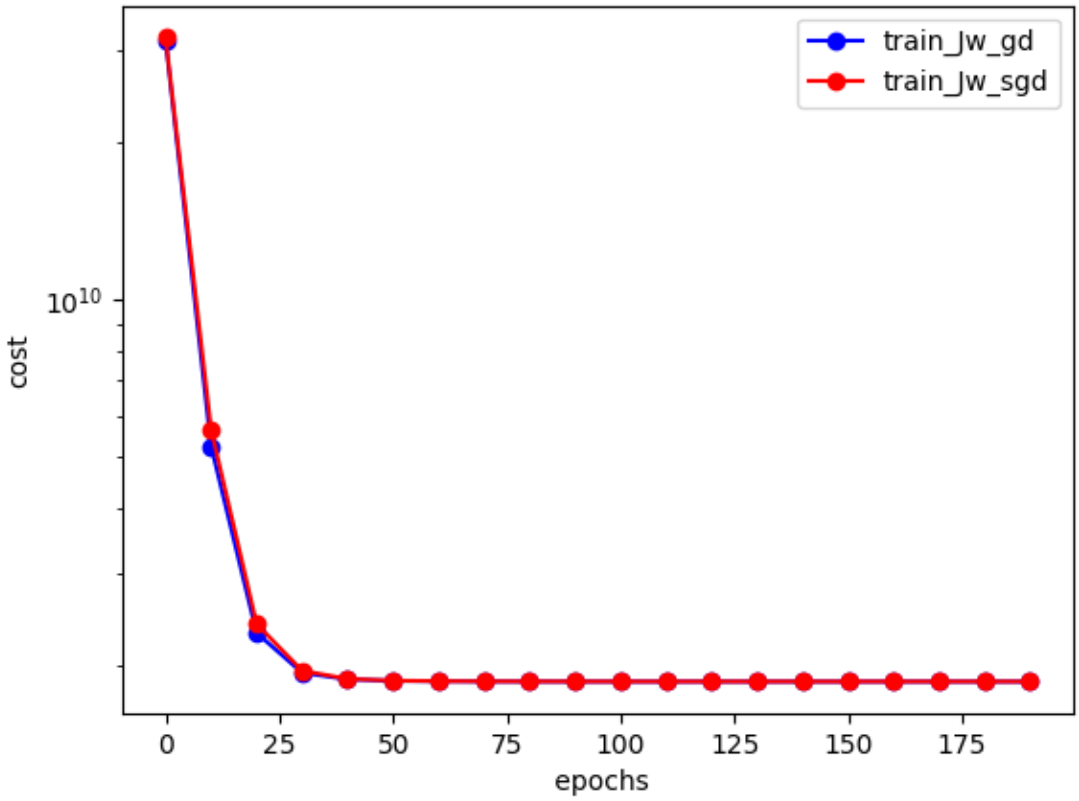

Explanation

The outcomes from both simple and multiple regression analyses offer valuable insights into the effectiveness of gradient descent techniques. In the simple regression case, both batch gradient descent (GD) and stochastic gradient descent (SGD) produce similar parameter estimates, albeit with slight discrepancies in the coefficients. However, there are observable differences in the training and test Root Mean Square Error (RMSE) and associated costs between the two methods.

RMSE serves as a measure of the average error magnitude, indicating deviations from actual values. Lower RMSE values signify better model performance and

predictions, with zero RMSE indicating a perfect fit. Similarly, in the context of the cost function, lower values are preferable as they indicate a smaller discrepancy between predicted and observed values, suggesting a better model fit.

In the case of simple regression, both training RMSE and cost are marginally higher for SGD compared to GD. However, test RMSE and cost are slightly lower for SGD, implying that SGD may exhibit slightly better generalization performance overall. On the other hand, in the multiple regression scenario, the performance differences between GD and SGD are akin to those observed in simple regression. Although both methods converge to similar parameter estimates, SGD tends to yield slightly higher training RMSE and cost but slightly lower test RMSE and cost. This suggests that SGD might be more effective in finding optimal solutions for complex regression tasks with multiple features.

In summary, both gradient descent (GD) and stochastic gradient descent (SGD) prove effective in minimizing the cost function. However, SGD exhibits promising advantages in computational efficiency and generalization performance, especially for tackling more intricate regression problems.