1 Experiment 1

The purpose of this experiment is to explore the effect of gamma value and inner tolerance on lasso regression using barrier function method. Configuration of the experiment:

- Dataset: a8a from LIBSVM
- Tested values of gamma: [5, 10, 50,100, 500, 1000]
- Tested values of inner tolerance: [1e-3, 1e-4, 1e-5, 1e-6, 1e-7, 1e-8, 1e-9, 1e-10]
- Initialized x: [5, ..., 5]
- Initialized u: x+0.01
- Regularization coefficient: 0.1

fig.1 shows result of experiment with different values of gamma. Upper graph shows effect on iteraion numbers and lower one shows effect on convergence time.

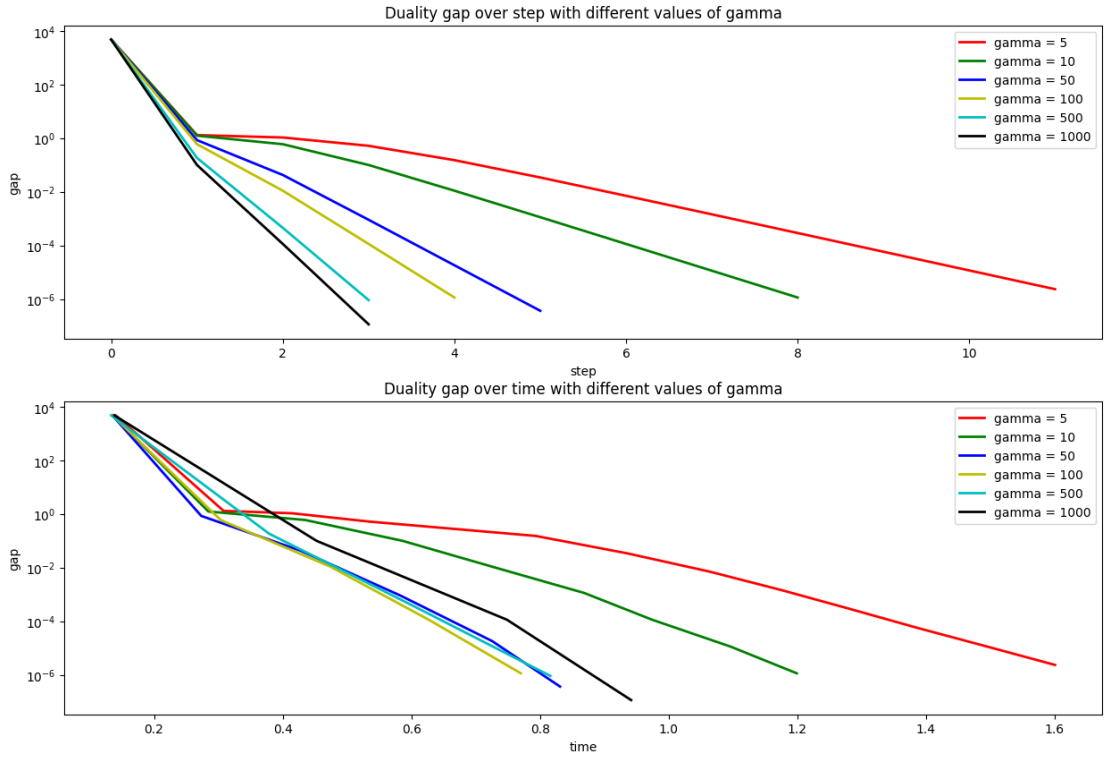

fig.1

fig.2 shows result of experiment with different values of inner tolerance. Upper graph shows effect on iteraion numbers and lower one shows effect on convergence time.

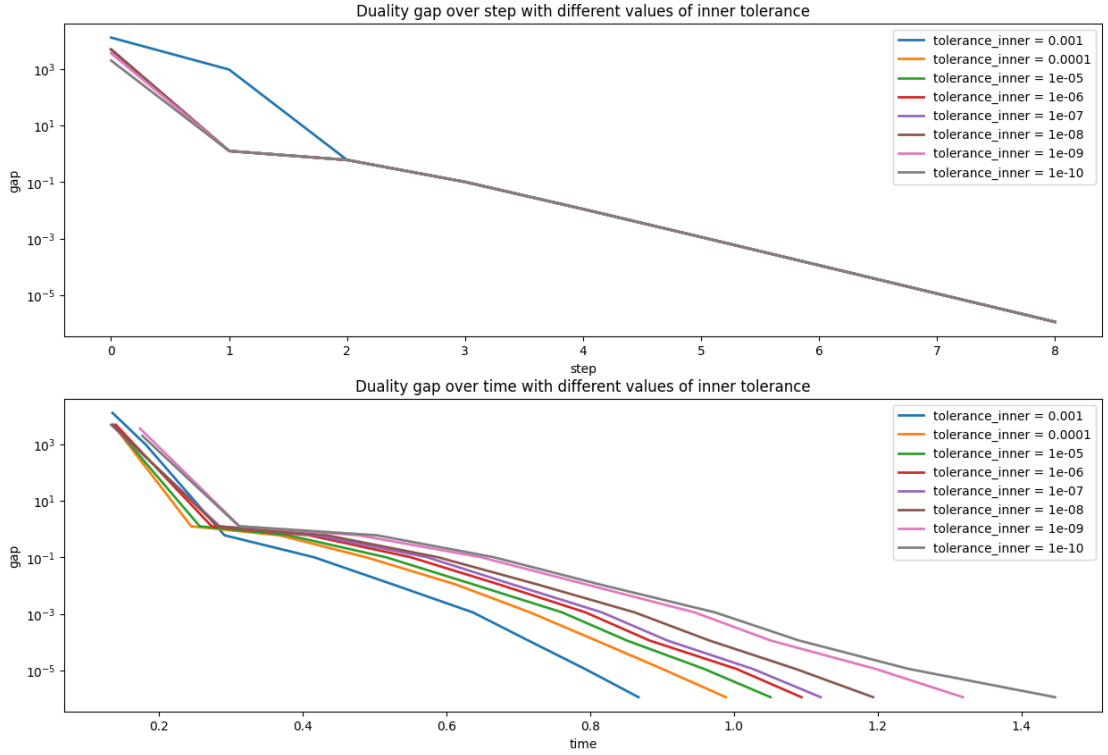

fig.2

From the first graph(fig.1) we can see that values of gamma affects both iteration numbers and convergence time. With higher value of gamma, the iterations and time needed become less.

From the second graph(fig.2) we can see that inner tolerance does not affect iterations much but affects convergence time a lot. With higher inner tolerance, convergence time becomes longer.

2 Experiment 2

This experiment is aimed to explore how the barrier method worsk with diffenrent data dimensions, data numbers and regularization coefficients. Configuration of this experiment:

- Values of data dimensions: [10, 50, 100, 500, 1000]
- Values of data numbers: [500, 1500, 2500, 3500, 4500 ,5500]
- Values of regularization coefficients(lambda): [0.1, 1, 10, 100]
- Initialized x: [5, ..., 5]
- Initialized u: x+0.01
- Dataset: randomly generated by np.random.rand with np.random.seed(45)
- In test for data dimensions: data numbers = 1000, lambda = 0.1
- In test for data numbers: data dimensions = 50, lambda = 0.1
- In test for lambdas: data numbers = 1000, data dimensions = 100

fig.3 shows duality gap over step with different data dimensions(upper) and duality gap over time with different data dimensions(lower).

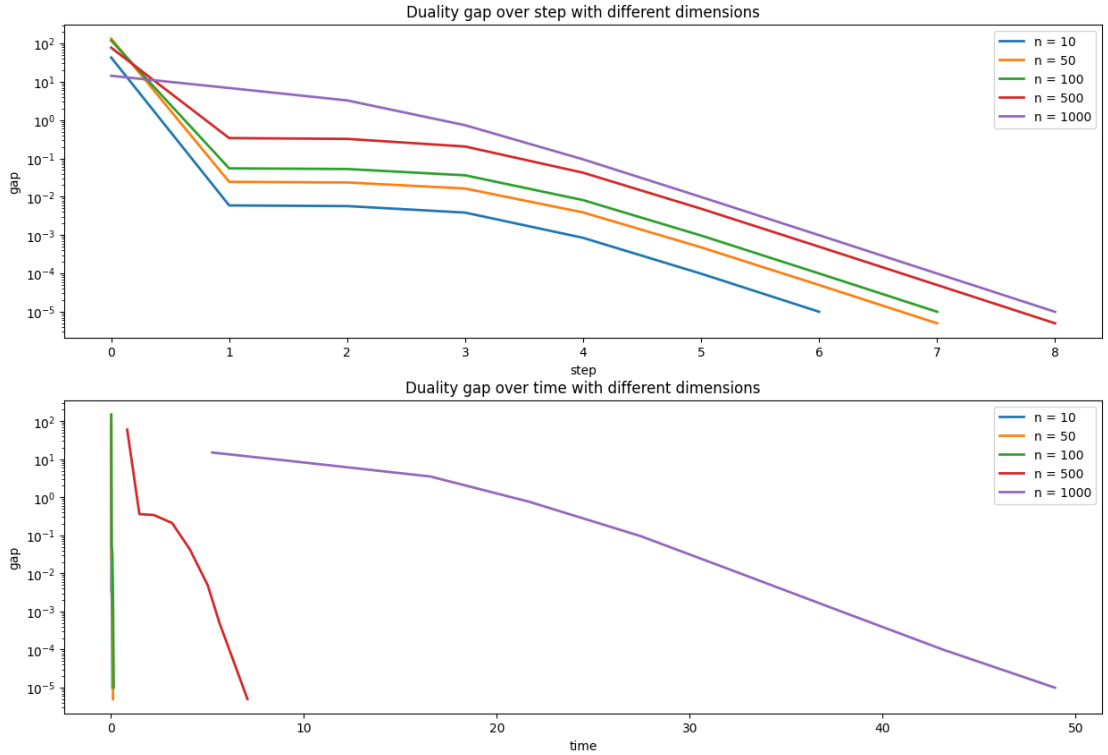

fig.3

fig.4 shows duality gap over step with different number of data(upper) and duality gap over time with different number of data(lower).

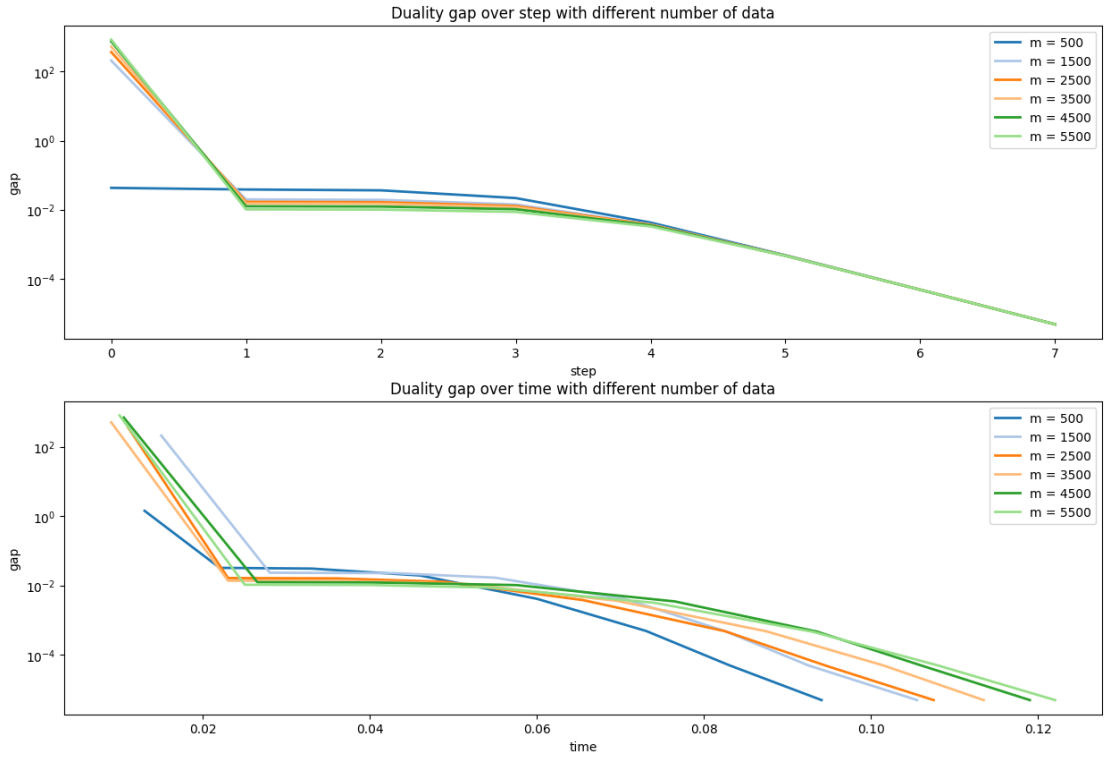

fig.4

fig.5 shows duality gap over step with different regularization coefficient(upper) and duality gap over time with different regularization coefficient(lower).

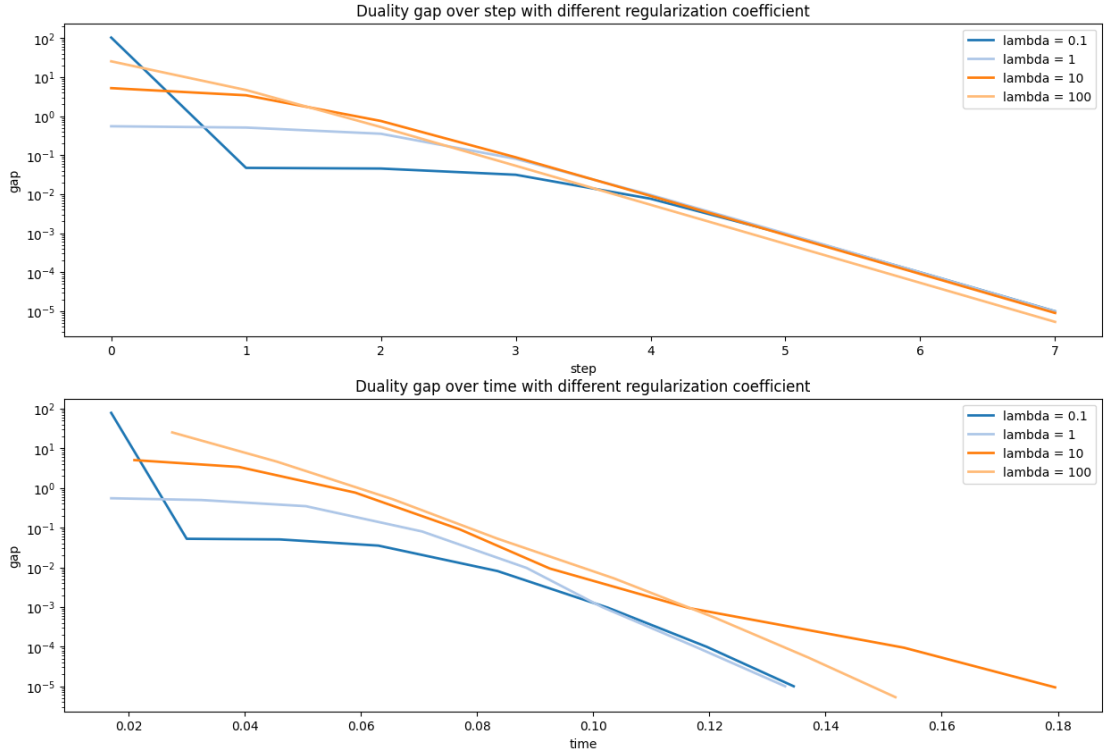

fig.5

From fig.3, we can see that as the data dimension increases, the number of iterations also increases on a small scale but the convergence time increases on a very large scale. It might because of the high time complexty of solving equation system.

From fig4, it's clear that iteration number are not affected by the number of datas at all. And also, the convergence time just affected by the number of datas on a very small scale. As m increases, the convergence time also increases a little.

From fig5, the upper graph shows that interation numbers are not affected by lambda. The impact of lambda on convergence time does not show any clear pattern; however, it is evident that the differences in convergence time across various lambda values are not significant.