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CS5487

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CS5487 Programming Assignment 1: regression

# PART 1 pOLYNOMINAL FUNCTION

## implementation

Implementation written in python is attached in the source code files.

## REGRESSION PLOTS AND HYPERPARAMETERS TUNNING

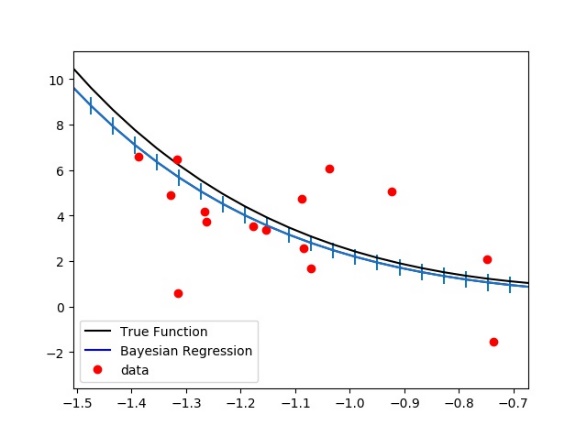
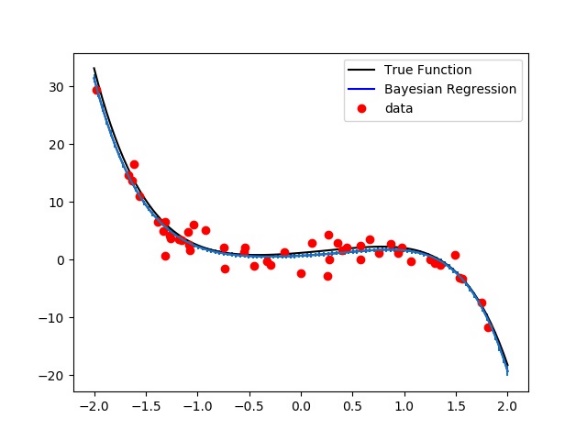
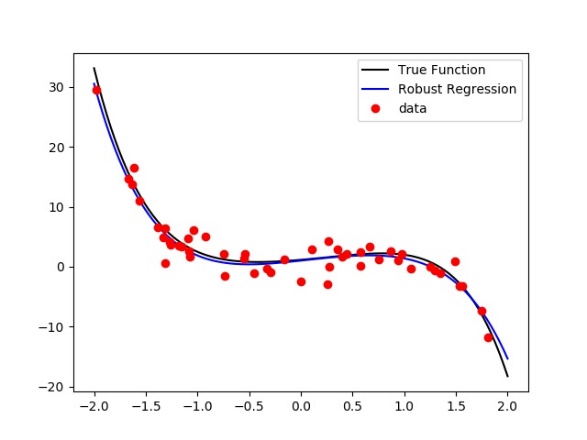
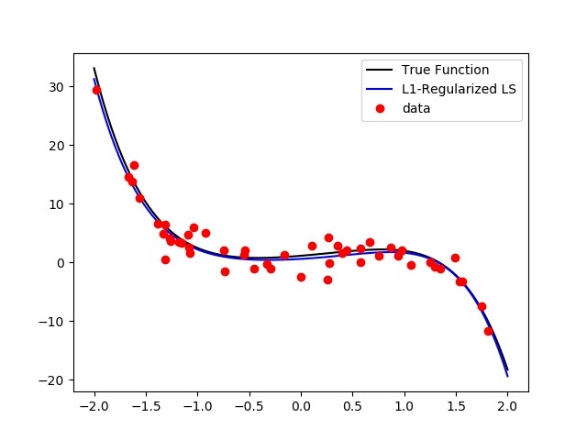
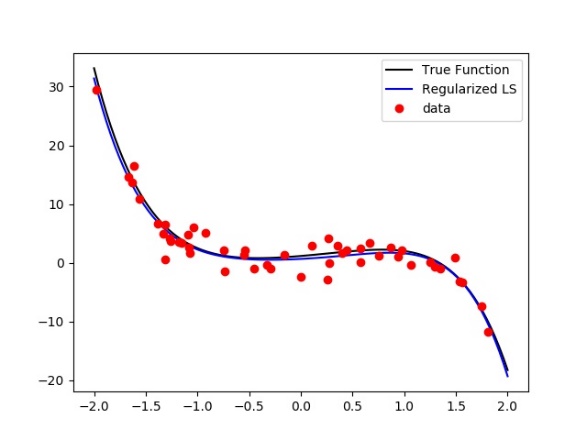
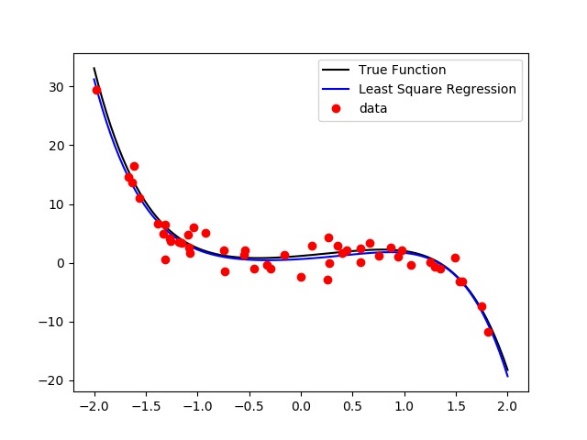


Figure 1: Plots of Different Regression Methods (figure in lower-right corner is the zoomed plot to show deviation of Bayesian Regression)

Figure 1 are plots of predictive functions of 5 different regression methods. Quadratic programming and linear programming solvers comes from the python package ‘cvxopt’. Hyperparameters (if any) are chosen by examining mean-square errors shown in Table 1. Values in bold type corresponds to ‘optimal hyperparameters’ in our experiments (noted that LS and RR required no hyperparameters). From the table, we can see that RLS (Regularized LS) and BR (Bayesian Regression) have the smallest MSE around 0.4076, a bit smaller than LS (Least-squares) and LASSO (L1-regularized LS) with 0.4086 and 0.4128 respectively while RR (Robust Regression) has a relatively larger number around 0.7680.

Table 1: Experiment mean-square errors of different hyperparameters

|  |  |  |
| --- | --- | --- |
|  | MSE of LS | MSE of RR |
| NA | 0.408644 | 0.768046 |

|  |  |
| --- | --- |
| Alpha and sigma | MSE of BR |
| 'alpha': 0.1, 'sigma': 0.1 | 0.408237 |
| 'alpha': 0.1, 'sigma': 0.5 | 0.420991 |
| 'alpha': 0.1, 'sigma': 1 | 0.557904 |
| 'alpha': 0.1, 'sigma': 5 | 2.895878 |
| 'alpha': 0.5, 'sigma': 0.1 | 0.408553 |
| 'alpha': 0.5, 'sigma': 0.5 | **0.4076** |
| 'alpha': 0.5, 'sigma': 1 | 0.415603 |
| 'alpha': 0.5, 'sigma': 5 | 1.238121 |
| 'alpha': 1, 'sigma': 0.1 | 0.408598 |
| 'alpha': 1, 'sigma': 0.5 | 0.407827 |
| 'alpha': 1, 'sigma': 1 | 0.408633 |
| 'alpha': 1, 'sigma': 5 | 0.856287 |
| 'alpha': 5, 'sigma': 0.1 | 0.408635 |
| 'alpha': 5, 'sigma': 0.5 | 0.408425 |
| 'alpha': 5, 'sigma': 1 | 0.407939 |
| 'alpha': 5, 'sigma': 5 | 0.459158 |

|  |  |  |
| --- | --- | --- |
| Lambda | MSE of RLS | MSE of LASSO |
| 0.1 | 0.408236518 | **0.412832** |
| 0.25 | 0.407826865 | 0.420168 |
| 0.5 | **0.407600224** | 0.434636 |
| 1 | 0.408632571 | 0.474607 |
| 2 | 0.415602545 | 0.519128 |
| 5 | 0.459157939 | 0.569842 |

## sample subsets and learning curves

In our experiment, subset sizes of samples are 20%, 40%, 60%, 80%. For each size of subset, we run 5 trials of different random subsets and take the average error. The sampling function comes from python package ‘scikit-learn’. On the other hand, we only plot the first-round function inside 5 same size trials. In this section, figure include plots range from 20% to 80% of the full dataset using the hypermeters from the previous section, full set figure is not provided for it is identity to plots in part (b).