

Exercise 1: Hypothesis Space, Capacity, Regularization

- (a) Simulate a data set with $n = 100$ observations based on the relationship $Y = \sin(x_1) + \varepsilon$ with noise term ε following some distribution. Simulate $p = 100$ additional covariates x_2, \dots, x_{101} that are not related to Y .
- (b) On this data set, use different models (and software packages) of your choice to demonstrate
- overfitting and underfitting;
 - $L1$, $L2$ and elastic net regularization;
 - the underdetermined problem;
 - the bias-variance trade-off;
 - early stopping (use a simple neural network as in Exercise 2).