AER850 Introduction to Machine Learning

Assignment 1

Marks. 10 Due on: February 2nd 2023, 2 pm

- This is an individual assignment.
- You are free to use libraries with general utilities, such as numpy and scipy for python.
- Be precise with your explanations in the report.
- You will be provided with a sample code that you can update or make your own code to solve this assignment. In case you use the sample code, you need to explain each step of the code in your updated code (with the comment statement # …#).
- Submit the assignment report along with your code on D2L by the due date.

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Model Selection

You are given Dataset-1 that consists of train, validation, and test files. The input is a real valued scalar and the output is also a real valued scalar. The dataset is generated from an n-degree polynomial and a small Gaussian noise is added to the target.

a) Fit a 20-degree polynomial to the data. Report the training and validation MSE (Mean-Square Error). Do not use any regularization. Visualize the fit. Comment about the quality of the fit.
b) Add L1 regularization to your model. Vary the value of λ from 0 to 1. For different values of λ, plot the training MSE and the validation MSE. Pick the best value of λ and report the test performance for the corresponding model. Also visualize the fit for the chosen model. Comment about the quality of the fit.
c) Add L2 regularization to your model. Vary the value of λ from 0 to 1. For different values of λ, plot the training MSE and the validation MSE. Pick the best value of λ and report the test performance for the corresponding model. Also visualize the fit for the chosen model. Comment about the quality of the fit.
d) Add Elastic net regularization to your model. Vary the value of r from 0 to 1. For different values of r, plot the training MSE and the validation MSE. Pick the best value of r and report the test performance for the corresponding model. Also visualize the fit for the chosen model. Comment about the quality of the fit.
e) What do you think is the degree of the source polynomial? Can you infer that from the visualization produced in the previous questions?