Aprendizagem 2022

Homework III – Group 019

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Part I: Pen and paper

1. **Consider the basis function, $\phi_j(x) = x^j$, for performing a 3-order polynomial regression,**

$$\hat{z}(x, w) = \sum_{j=0}^{3} w_j \phi_j(x) = w_0 + w_1 x + w_2 x^2 + w_3 x^3.$$

   Learn the Ridge regression (l_2 regularization) on the transformed data space using the closed-form solution with $\lambda = 2$.

2. **Compute the training RMSE for the learnt regression model.**

3. **Consider a multi-layer perceptron characterized by one hidden layer with 2 nodes. Using the activation function $f(x) = e^{0.1x}$ on all units, all weights initialized as 1 (including biases), and the half squared error loss, perform one batch gradient descent update (with learning rate $\eta = 0.1$) for the first three observations (0.8), (1) and (1.2).**

Part II: Programming

Lorem ipsum thingies

4. **Compute the MAE of the three regressors: linear regression, MLP_1 and MLP_2.**

5. **Plot the residues (in absolute value) using two visualizations: boxplots and histograms.**

6. **How many iterations were required for MLP_1 ans MLP_2 to converge?**

7. **What can be motivating the unexpected differences on the number of iterations? Hypothetize one reason underlying the observed performance differences between the MLPs.**

Appendix