

Multi-Layer Perceptron*

*Structural Machine Learning

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Abstract—Multi-Layer Perceptron(MLP) is a simplest neural network structural in some simple problems like regressions or multilabel classifications. We will build a 3-layers MLP with Python to complete a regression task on Boston Housing Data.

I. DATASETS

I use Boston Housing Data as the train and test data. I directly import the data from tensorflow datasets. Boston Housing Data consist of 404 train data and 102 test data with 13 features.

II. MULTI-LAYER PERCEPTRON

We use a simple 3-layer MLP as training model. The model is originally using for multilabel classification. We adjust some function and parameters to let the model training well in our regression problem.

I implement the dropout function on the training process. I shut down the neuron randomly for each training step except the last training steps. I use the Xavier initialization as the initial weight for the model. I change the activation function from sigmoid to Relu for the regression problems. Also the output dimension is changed to 1.

III. EXPERIMENT

We predict the test data given by the trained model. The predicted cost after 100 epochs is about 26.3430 . I also using a tensorflow model with 16-32-16 perceptron to predict as a comparison. The result of tensorflow built model has a prediction cost 43.5085 .

Fig.1 shows the cost of the MLP model. Fig.2 is the plot of ground truth and the prediction by the model. The straight line in the plot is the points should lie on if the prediction has high consistent with the ground truth.

IV. N-LAYER PERCEPTRON

I have training the model again with 13-layer perceptron as we have 13 features for datasets. I found that the cost function converge more stable on the training steps. The loss I get from the 13-layer MLP is 17.651 which is lower than 3-layer perceptron. Fig.3 and Fig.4 show the cost and the plot of testing data and prediction by 13-layer perceptron.

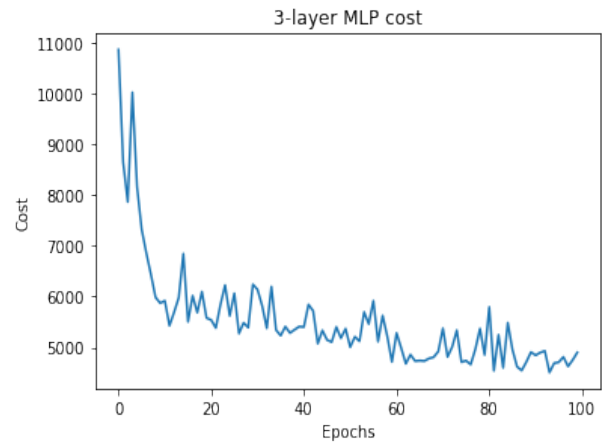


Fig. 1. The cost of MLP model against to epochs.

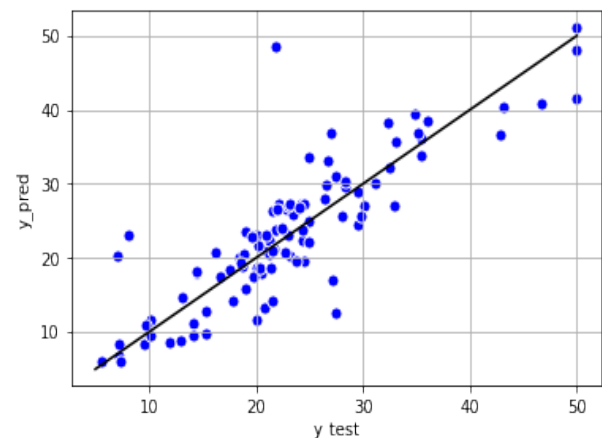


Fig. 2. The plot with prediction against the ground truth.

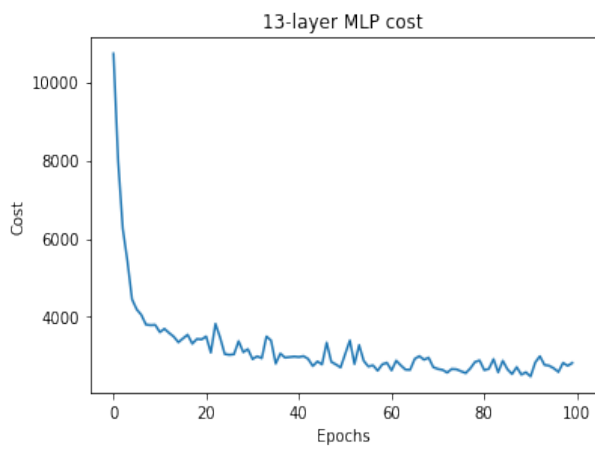


Fig. 3. The cost of MLP model against to epochs.

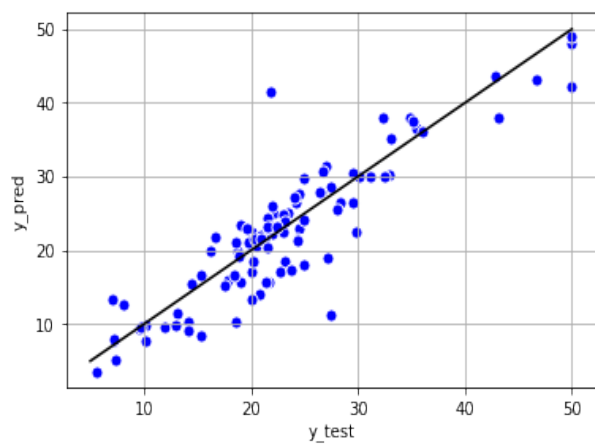


Fig. 4. The cost of MLP model against to epochs.