

Machine Learning Applications for Wireless Communications

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Deep Learning Methods for Modulation Classification

Task:

To identify the modulation classes in the given data sets. There will be 3 modulation classes sent over an impulsive noise environments. The challenge is to design the best classifier.

Data Set Information:

The data is provided in the form of (I,Q) samples. The data set has been generated using Matlab at 20 dB SNR. The modulation schemes have unit energy.

Architecture Used:

Input → 1st Hidden Layer → 2nd Hidden Layer → Output

Size of hidden layers used are 150 and 50 respectively obtained after deep analysis to get a maximum accuracy.

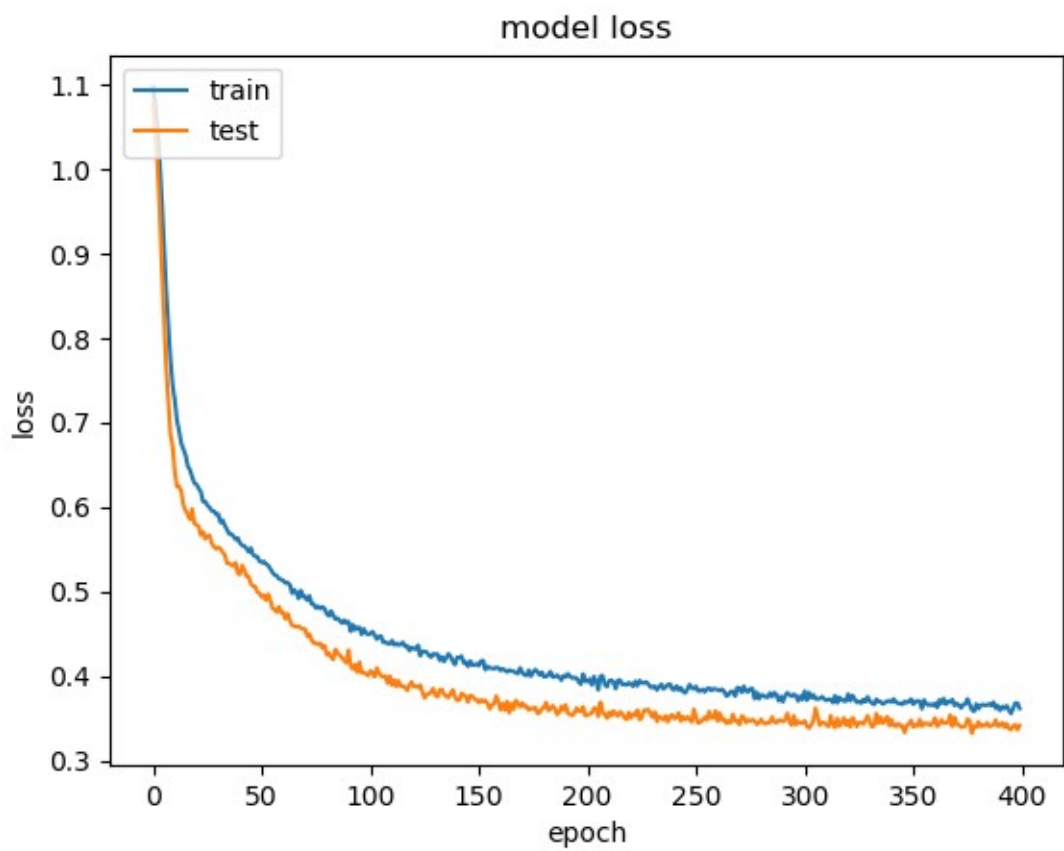
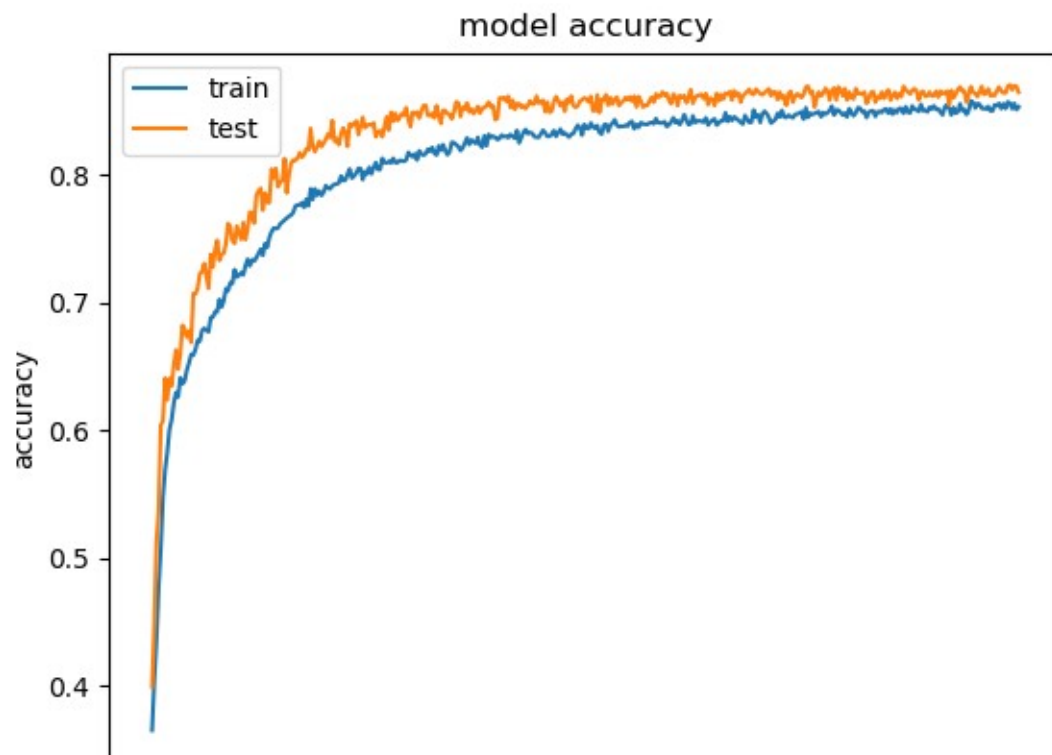
For Loss:

Categorical cross entropy was used. It compares the predicted label and true label and calculates the loss.

Optimization Method:

Trained over different optimization methods (Stochastic Gradient Descent , AdaGrad , RMSprop , Adam) using mlp_keras code and compared to rule out the best that is Adam.

Graphs:



Codes:

1-mlp_scratch

Code of MLP from scratch using just numpy directory. The model was trained with the given architecture for 300 epochs with Stochastic Gradient Descent as the optimizer but the max accuracy reached was just 0.616 .

2-mlp_keras

Code of MLP using keras framework. The model was trained with the given architecture for 400 epochs with Adam as the optimizer leading to a maximum validation accuracy as 0.878 .