Applicability of Cross-validation Error in Neural Networks

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Cross-validation is a technique to measure the predictive performance of a model. This document discusses different methods of cross-validation and their applicability to neural networks.

Holdout Sample

Data is split into two groups – training and test data. The training set is used to train the learner. The test set is used to estimate the error rate of the trained model. This method has two basic drawbacks – in a sparse/small data set, one may not be able to set aside a reasonable portion of the data for testing. Since it is a single repetition of the train-and-test experiment, the error estimate is not stable. If the data sample has a non-representative (“bad”) split, the estimate will not be reliable.

Three-Way Split

The available data is partitioned into three sets: training, validation and test set.

References

[Applied Data Mining and Statistical Learning, Lecture 2, STAT 897D, Penn State](https://online.stat.psu.edu/stat857/node/161/)

[Cross-validatory Choice and Assessment of Statistical Prediction, M. Stone, University College London, 1974](https://github.com/dimitarpg13/probabilistic_machine_learning/blob/main/applied_statistics/articles/Cross-validatory_Choice_and_Assessment_of_Statistical_Predictions_Stone1974.pdf)

[How to use k-fold cross validation error in neural network, StackOverflow, last modified 5/2017](https://stackoverflow.com/questions/25889637/how-to-use-k-fold-cross-validation-in-a-neural-network)