**Reading Assignment 3**

In the paper *Experiment Databases: Towards an Improved Experimental Methodology in Machine Learning* the author describes the structure, implementation, and applications of experiment databases. An experiment database is a database of detailed information on machine learning (ML) algorithm experiments that includes the algorithm, the dataset being used, and the performance of the experiment. Before experiment databases, when a person created a new ML algorithm it was very difficult to gauge its effectiveness compared to other ML algorithms. Being able to compare a new ML algorithm to others has streamlined the process of creating new state-of-the-art ML algorithms. An experiment database must be able to contain a large number of experiments in a standardized form that is easy to use and compare results with.

The structure of an experiment database should be able to contain enough information on each experiment that it is repeatable and reusable. The algorithm’s source code is either stored in the database or a pointer to its source code is stored. If the algorithm has parameters those also must be stored with the algorithm. In addition to the algorithm’s source code and its parameters any characteristics or common features that may be shared with other algorithms should be stored so similar algorithms are easier to find. Datasets should also store their source code and characteristics. If the dataset is created from a dataset generator any parameters inputted into the generator should be included with the dataset along with the dataset generator’s source code. How the experiment is evaluated also needs to be stored in the database. This includes the methods used for evaluation and their output. A larger variety of evaluation metrics increases the experiment’s reusability. If a model was created by the algorithm including the model or some of the model’s properties in the database will help others understand the experiment without having to recreate the whole thing.

In order to implement an experiment database a wide range of experiments must be included. Also only experiments of interest should be included and any redundant or unhelpful experiments should be excluded. Finding datasets to include can be difficult. Importing datasets from information databases is an easy way to expand your datasets. Another possible way of increasing your datasets is using a dataset generator. Information on the dataset should be included so that datasets with specific conditions can be found easily. Once a sufficient amount of datasets are found you need to run them on the right ML algorithms. If an algorithm has input parameters the algorithm should be run at least 100 times for each unique parameter. To detect n-order interactions between parameters the algorithm should be run where p is the number of unique parameters and n is the n-order of interactions. Most experiments do not investigate n-order interactions higher than two.

One example given in the paper is using an experiment database to query the results of Random Forest on a dataset called waveform-5000. The experiment database is stored in a SQL database. By querying the Random Forest algorithm and the waveform-5000 dataset the database returns all the experiments run (including all the different parameters used) and their predictive accuracy. Looking at the results you can quickly tell which Random Forest parameters worked best on each of the problems in the dataset. This example is pretty basic but could be very useful for someone working with Random Forest or waveform-5000. In conclusion experiment databases have a lot of potential and someone developing experimental ML algorithms may save a lot of time and effort by using one.