bnn_mvp_model_selection

August 21, 2015

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In [4]: """
        The intent of this notebook is model selection and
        evaluation for the MVP of our brainNN classifier.
        import sys
        import matplotlib
        import numpy as np
        import matplotlib.pyplot as plt
        import pandas as pd
        from tornado import gen
        from tornado.ioloop import IOLoop
        import aimetrics as aim
        import aimetrics.metrics as aim_metrics
        import seaborn as sns
        %matplotlib inline
In [5]: X_trn_val = pd.read_csv('output/bnn-mvp/X_trn_val.csv', index_col=0)
        y_trn_val = pd.read_csv('output/bnn-mvp/y_trn_val.csv', index_col=0)
        X_test = pd.read_csv('output/bnn-mvp/X_test.csv', index_col=0)
        y_test = pd.read_csv('output/bnn-mvp/y_test.csv', index_col=0)
        labels = ['small_drone', 'person']
        # create data storage variable
       metrics = {}
In [6]: from sklearn.cross_validation import StratifiedKFold
        # put together k-fold output
        skf = StratifiedKFold(y_trn_val['small_drone'], 5)
        @gen.coroutine
        def get_default_metrics():
            indx = list(skf) # for debugging
            metrics['default'] = yield [
                aim_metrics.remote_classifier_metrics(
                    'http://localhost:3002/',
                    'bnn'.
                    X_trn_val.iloc[trn_ind].values,
                    y_trn_val.iloc[trn_ind].values,
                    X_trn_val.iloc[val_ind].values,
                    y_trn_val.iloc[val_ind].values,
                    labels
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)
                for trn_ind, val_ind in indx
            ٦
        IOLoop.instance().add_callback(get_default_metrics)
In [ ]: row_range = range(0, 6)
        col_range = range(2,7)
        rate_range = np.arange(0.1, 0.8, 0.1)
        n_folds = 5
        print("TESTING %d MODELS" % (len(row_range)*len(col_range)*len(rate_range)*n_folds)
        @gen.coroutine
        def get_param_grid_metrics():
            yield [get_param_metrics(nrows, ncols, learning_rate=rate) for nrows in row_range for ncols
            print("PARAMETER SEARCH COMPLETE")
        @gen.coroutine
        def get_param_metrics(n_hidden_rows, ncols, learning_rate=None):
            """Get the metrics for a particular parameter set. Assumes a grid topo"""
            skf = StratifiedKFold(y_trn_val['small_drone'], n_folds)
            params = {'hiddenLayers': [ncols] * n_hidden_rows}
            if learning_rate:
                params['learningRate'] = learning_rate
            key = 'x'.join((str(n_hidden_rows), str(ncols), str(learning_rate)))
            metrics[key] = yield [
                aim_metrics.remote_classifier_metrics(
                    'http://localhost:3002/',
                    'bnn',
                    X_trn_val.iloc[trn_ind].values,
                    y_trn_val.iloc[trn_ind].values,
                    X_trn_val.iloc[val_ind].values,
                    y_trn_val.iloc[val_ind].values,
                    labels,
                    model_params = params,
                for trn_ind, val_ind in skf
            print("%s Complete" % key)
        IOLoop.instance().add_callback(get_param_grid_metrics)
In [8]: def get_score_report(key, score, agg):
            stats = pd.Series([r[score] for r in metrics[key]]).describe()
            return stats[agg]
In [13]: scores = ['roc_auc', 'acc', 'f1_score']
         aggs = ['mean', 'std']
         report = pd.DataFrame({
                 score + "_" + agg: pd.Series({
                         key: get_score_report(key, score, agg) for key in metrics.keys()
                 }) for score in scores for agg in aggs
         })
         report.sort("roc_auc_mean", ascending=False)
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2x6x0.5 0.720635 6.106471e-02 0.695156 6.002805e-02 0.770813 1x2x0.4 0.726984 6.188441e-02 0.704442 6.158310e-02 0.770574 2x6x0.6 0.723810 4.840619e-02 0.699131 4.554871e-02 0.770574 1x5x0.4 0.720635 6.602106e-02 0.695074 6.922460e-02 0.770335 1x2x0.5 0.720635 6.106471e-02 0.697888 5.774796e-02 0.770335 1x2x0.3 0.723810 6.002106e-02 0.70435 6.587214e-02 0.770396 1x5x0.3 0.723810 6.602106e-02 0.70435 6.587214e-02 0.77096 1x5x0.3 0.73310 6.602106e-02 0.70435 6.587214e-02 0.77096 1x5x0.3 0.73310 6.06471e-02 0.701711 6.237541e-02 0.77096 1x5x0.3 0.723810 6.303999e-02 0.698249 6.713256e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717	1x6x0.5	0.717460	6.085806e-02	0.691295	6.203974e-02	0.771292
1x2x0.4 0.726984 6.188441e-02 0.704442 6.158310e-02 0.770574 2x6x0.6 0.723810 4.840619e-02 0.699131 4.554871e-02 0.770574 1x5x0.4 0.720635 6.602106e-02 0.695074 6.922460e-02 0.770335 1x2x0.5 0.720635 6.106471e-02 0.697888 5.774796e-02 0.770335 1x2x0.3 0.723810 6.002106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x3x0.3 0.73810 6.602106e-02 0.70435 6.587214e-02 0.770096 1x3x0.3 0.73810 6.602106e-02 0.70435 6.587214e-02 0.770096 1x5x0.3 0.73810 6.106471e-02 0.701711 6.237541e-02 0.77096 1x6x0.3 0.723810 6.106471e-02 0.701711 6.237541e-02 0.769856 2x5x0.7 0.702635 3.984095e-02 0.6982722 3.324309e-02 0.769856 2x5x0.3 0	1x3x0.4	0.723810	6.602106e-02	0.700435	6.587214e-02	0.771053
2x6x0.6 0.723810 4.840619e-02 0.699131 4.554871e-02 0.770574 1x5x0.4 0.720635 6.602106e-02 0.695074 6.922460e-02 0.770335 1x2x0.5 0.720635 6.106471e-02 0.697888 5.774796e-02 0.770335 1x2x0.3 0.723810 6.002435e-02 0.70435 6.587214e-02 0.770096 1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x3x0.3 0.730159 5.832118e-02 0.70316 5.845061e-02 0.770096 1x6x0.3 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723810 6.309399e-02 0.698499 6.713256e-02 0.769976 2x5x0.7 0.720635 5.566882e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.6974395 7.450581e-09 0.500000 5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 <	2x6x0.5	0.720635	6.106471e-02	0.695156	6.002805e-02	0.770813
1x5x0.4 0.720635 6.602106e-02 0.695074 6.922460e-02 0.770335 1x2x0.5 0.720635 6.106471e-02 0.697888 5.774796e-02 0.770335 1x2x0.3 0.723810 6.002435e-02 0.701843 6.068017e-02 0.77036 1x4x0.4 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.730159 5.832118e-02 0.708316 5.845061e-02 0.770096 default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723610 6.309399e-02 0.698949 6.713256e-02 0.769856 2x5x0.7 0.720635 3.984095e-02 0.698722 3.324309e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 2x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.1 <	1x2x0.4	0.726984	6.188441e-02	0.704442	6.158310e-02	0.770574
1x2x0.5 0.720635 6.106471e-02 0.697888 5.774796e-02 0.770335 1x2x0.3 0.723810 6.002435e-02 0.701843 6.668017e-02 0.770335 1x4x0.4 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x3x0.3 0.730159 5.832118e-02 0.708316 5.845061e-02 0.770096 default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 5.566882e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.692722 3.324309e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.698412 6.597280e-02 0.769856 5x4x0.1 0.698413 <td>2x6x0.6</td> <td>0.723810</td> <td>4.840619e-02</td> <td>0.699131</td> <td>4.554871e-02</td> <td>0.770574</td>	2x6x0.6	0.723810	4.840619e-02	0.699131	4.554871e-02	0.770574
1x2x0.3 0.723810 6.002435e-02 0.701843 6.068017e-02 0.770335 1x4x0.4 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x3x0.3 0.730159 5.832118e-02 0.708316 5.845061e-02 0.770096 default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723810 6.309399e-02 0.698494 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.69741 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.500000 5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 <	1x5x0.4	0.720635	6.602106e-02	0.695074	6.922460e-02	0.770335
1x4x0.4 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x5x0.3 0.730159 5.832118e-02 0.700316 5.845061e-02 0.770096 default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.769976 1x6x0.3 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 0x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	1x2x0.5	0.720635	6.106471e-02	0.697888	5.774796e-02	0.770335
1x5x0.3 0.723810 6.602106e-02 0.700435 6.587214e-02 0.770096 1x3x0.3 0.730159 5.832118e-02 0.708316 5.845061e-02 0.770096 default 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 <td>1x2x0.3</td> <td>0.723810</td> <td>6.002435e-02</td> <td>0.701843</td> <td>6.068017e-02</td> <td>0.770335</td>	1x2x0.3	0.723810	6.002435e-02	0.701843	6.068017e-02	0.770335
1x3x0.3 0.730159 5.832118e-02 0.708316 5.845061e-02 0.770096 default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 <td>1x4x0.4</td> <td>0.723810</td> <td>6.602106e-02</td> <td>0.700435</td> <td>6.587214e-02</td> <td>0.770096</td>	1x4x0.4	0.723810	6.602106e-02	0.700435	6.587214e-02	0.770096
default 0.723810 6.106471e-02 0.701711 6.237541e-02 0.770096 1x6x0.3 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856	1x5x0.3	0.723810	6.602106e-02	0.700435	6.587214e-02	0.770096
1x6x0.3 0.723810 6.309399e-02 0.698949 6.713256e-02 0.769976 2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	1x3x0.3	0.730159	5.832118e-02	0.708316	5.845061e-02	0.770096
2x4x0.6 0.720635 3.984095e-02 0.692722 3.324309e-02 0.769856 2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	default	0.723810	6.106471e-02	0.701711	6.237541e-02	0.770096
2x5x0.7 0.720635 5.566882e-02 0.687041 6.041036e-02 0.769856 2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856	1x6x0.3	0.723810	6.309399e-02	0.698949	6.713256e-02	0.769976
2x5x0.3 0.717460 6.388766e-02 0.695462 6.597280e-02 0.769856 5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	2x4x0.6	0.720635	3.984095e-02	0.692722	3.324309e-02	0.769856
5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	2x5x0.7	0.720635	5.566882e-02	0.687041	6.041036e-02	0.769856
5x4x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	2x5x0.3	0.717460	6.388766e-02	0.695462	6.597280e-02	0.769856
5x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000						
4x5x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	5x4x0.1	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
5x4x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	5x4x0.2	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
5x4x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x5x0.1	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
5x4x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	5x4x0.3	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
5x4x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	5x4x0.4	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x5x0.5 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	5x4x0.5	0.698413		0.574395		
4x4x0.20.6984131.490116e-080.5743957.450581e-090.5000004x4x0.70.6984131.490116e-080.5743957.450581e-090.5000004x3x0.20.6984131.490116e-080.5743957.450581e-090.5000003x2x0.30.6984131.490116e-080.5743957.450581e-090.5000004x2x0.10.6984131.490116e-080.5743957.450581e-090.5000004x2x0.20.6984131.490116e-080.5743957.450581e-090.5000004x2x0.30.6984131.490116e-080.5743957.450581e-090.5000004x2x0.40.6984131.490116e-080.5743957.450581e-090.5000004x2x0.60.6984131.490116e-080.5743957.450581e-090.5000004x2x0.70.6984131.490116e-080.5743957.450581e-090.5000004x3x0.10.6984131.490116e-080.5743957.450581e-090.500000		0.698413		0.574395	7.450581e-09	0.500000
4x4x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x5x0.5	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x3x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x4x0.2	0.698413		0.574395		
3x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x4x0.7	0.698413				
4x2x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x3x0.2	0.698413		0.574395		
4x2x0.2 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	3x2x0.3	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x2x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000	4x2x0.1			0.574395		
4x2x0.4 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.6 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000						
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4x2x0.7 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000 4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000						
4x3x0.1 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000						
4x3x0.3 0.698413 1.490116e-08 0.574395 7.450581e-09 0.500000						
	4x3x0.3	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000

4x4x0.6	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x3x0.4	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x3x0.5	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x3x0.6	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x3x0.7	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x4x0.1	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x4x0.3	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x4x0.4	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x4x0.5	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000
4x2x0.5	0.698413	1.490116e-08	0.574395	7.450581e-09	0.500000

roc_auc_std

1x4x0.7	0.026029
1x6x0.6	0.024508
1x5x0.7	0.024962
1x5x0.6	0.027629
1x4x0.6	0.029170
1x2x0.6	0.027699
1x4x0.5	0.026199
1x6x0.7	0.028653
2x6x0.7	0.027621
1x5x0.5	0.028198
1x3x0.7	0.027164
1x2x0.7	0.028096
1x3x0.5	0.028002
1x3x0.6	0.028256
1x6x0.5	0.026979
1x3x0.4	0.028616
2x6x0.5	0.026769
1x2x0.4	0.028638
2x6x0.6	0.026699
1x5x0.4	0.028783
1x2x0.5	0.028218
1x2x0.3	0.029043
1x4x0.4	0.027686
1x5x0.3	0.027439
1x3x0.3	0.028924
default	0.027429
1x6x0.3	0.029207
2x4x0.6	0.029075
2x5x0.7	0.026769
2x5x0.3	0.025885
· · ·	
5x4x0.1 5x4x0.2	0.000000
5x4x0.2 $4x5x0.1$	0.000000
	0.000000
5x4x0.3	
5x4x0.4 5x4x0.5	0.000000
5x4x0.5 $5x4x0.6$	0.000000
4x5x0.5	0.000000
4x5x0.5 $4x4x0.2$	0.000000
4x4x0.2 $4x4x0.7$	0.000000
4x4x0.7 4x3x0.2	0.000000
4X3XU.2	0.000000

```
3x2x0.3
                     0.000000
         4x2x0.1
                     0.000000
         4x2x0.2
                     0.000000
         4x2x0.3
                     0.000000
         4x2x0.4
                     0.000000
         4x2x0.6
                     0.000000
         4x2x0.7
                     0.000000
         4x3x0.1
                     0.000000
         4x3x0.3
                     0.000000
         4x4x0.6
                     0.000000
         4x3x0.4
                     0.000000
         4x3x0.5
                     0.000000
         4x3x0.6
                     0.000000
                     0.000000
         4x3x0.7
         4x4x0.1
                     0.000000
         4x4x0.3
                     0.000000
         4x4x0.4
                     0.000000
         4x4x0.5
                     0.000000
         4x2x0.5
                     0.000000
         [182 rows x 6 columns]
In [14]: import json
         with open("../output/bnn-mvp/param_metrics.json", 'w') as f:
             json.dump(metrics, f)
         report.to_csv("../output/bnn-mvp/param_metrics_summary.csv")
In [11]: """
         Conclusion:
         The 1-layer NN's almost categorically outperformed the others
         in roc_auc. Of those, 1x4x0.7 was the best performer by a very
         small margin. Therefore, it will be the selected model for our
         MVP. However, I want to confirm this with an increased search
         space this evening, in order to rule out somewhat larger
         dimensions.
         Selected Params:
             hiddenLayers: [4],
             learningRate: 0.7
         11 11 11
         pass
In []:
In []:
```