Deep Learning Lab: Exercise 2 (AutoML)

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1 Configuration space

The problem at hand involves a Neural Architecture Search over a configuration space of 9 categorical dimensions. The configuration space is as follows:

- activation_fn_1: {tanh, relu}
- activation_fn_2: {tanh, relu}
- batch_size: {8, 16, 32, 64}
- dropout_1: {0.0, 0.3, 0.6}
- dropout_2: {0.0, 0.3, 0.6}
- init_lr: {0.0005, 0.001, 0.005, 0.01, 0.05, 0.1}
- lr_schedule: {cosine, const}
- n_units_1: {16, 32, 64, 128, 256, 512}
- n_units_2: {16, 32, 64, 128, 256, 512}

2 Random Search

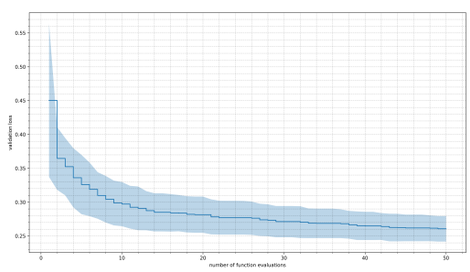

Figure 1: Budget of 50 function evaluations over 50 runs

3 Bayesian Optimisation

In this section, the results for Bayesian Optimisation (BO) will be shown. Two variants of BO were used, differing in the acquisition functions used: Random Forests and Neural Networks. Both these techniques can deal with categorical data. For a similar reasoning, a form of Stochastic Local Search (Variable Neighbourhood Ascent) was used for optimizing the acquisition function. The results are shown below.

3.1 Random Forest

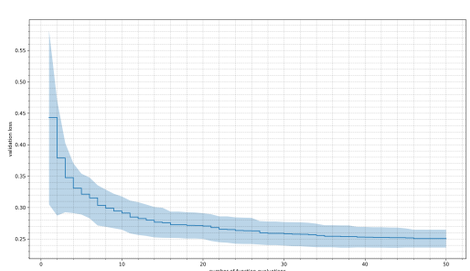

Figure 2: Budget of 50 function evaluations over 50 runs

3.2 Neural Network

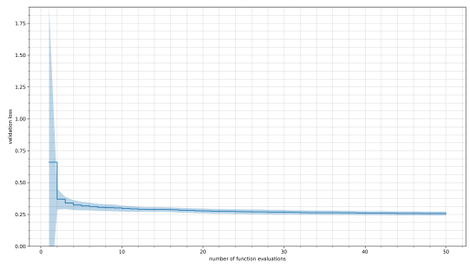

Figure 3: Budget of 50 function evaluations over 50 runs

4 Comparison

The three techniques were compared with the configuration that yielded the global minima for the test evaluations.

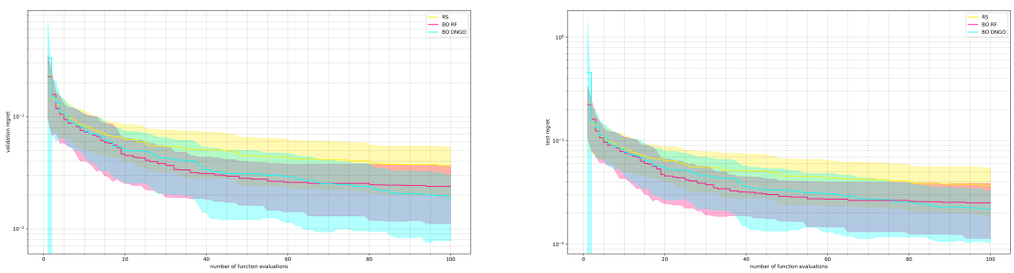

Figure 4: Budget of 100 function evaluations over 30 runs

5 Sample Result Comparison

The configurations and loss for the 3 techniques shown below are for the *minimum recorded loss* in all the runs, and its corresponding configuration.

Parameters	Best	RS	BO RF	BO DNGO
activation_fn_1	'relu'	'relu'	'relu'	'relu'
activation_fn_2	'relu'	'relu'	'relu'	'relu'
batch_size	8	32	8	64
dropout_1	0.0	0.0	0.0	0.3
dropout_2	0.3	0.0	0.3	0.0
init_lr	0.0005	0.001	0.0005	0.001
lr_schedule	'cosine'	'cosine'	'cosine'	'cosine'
n_units_1	512	512	256	512
n_units_2	512	128	512	512
Test MSE:	0.221379	0.227006	0.221573	0.221111