# Using Evolutionary Algorithms for Hyperparameter Tuning and Network Reduction Techniques to Classify Core Porosity Classes based on Petrographical Descriptions

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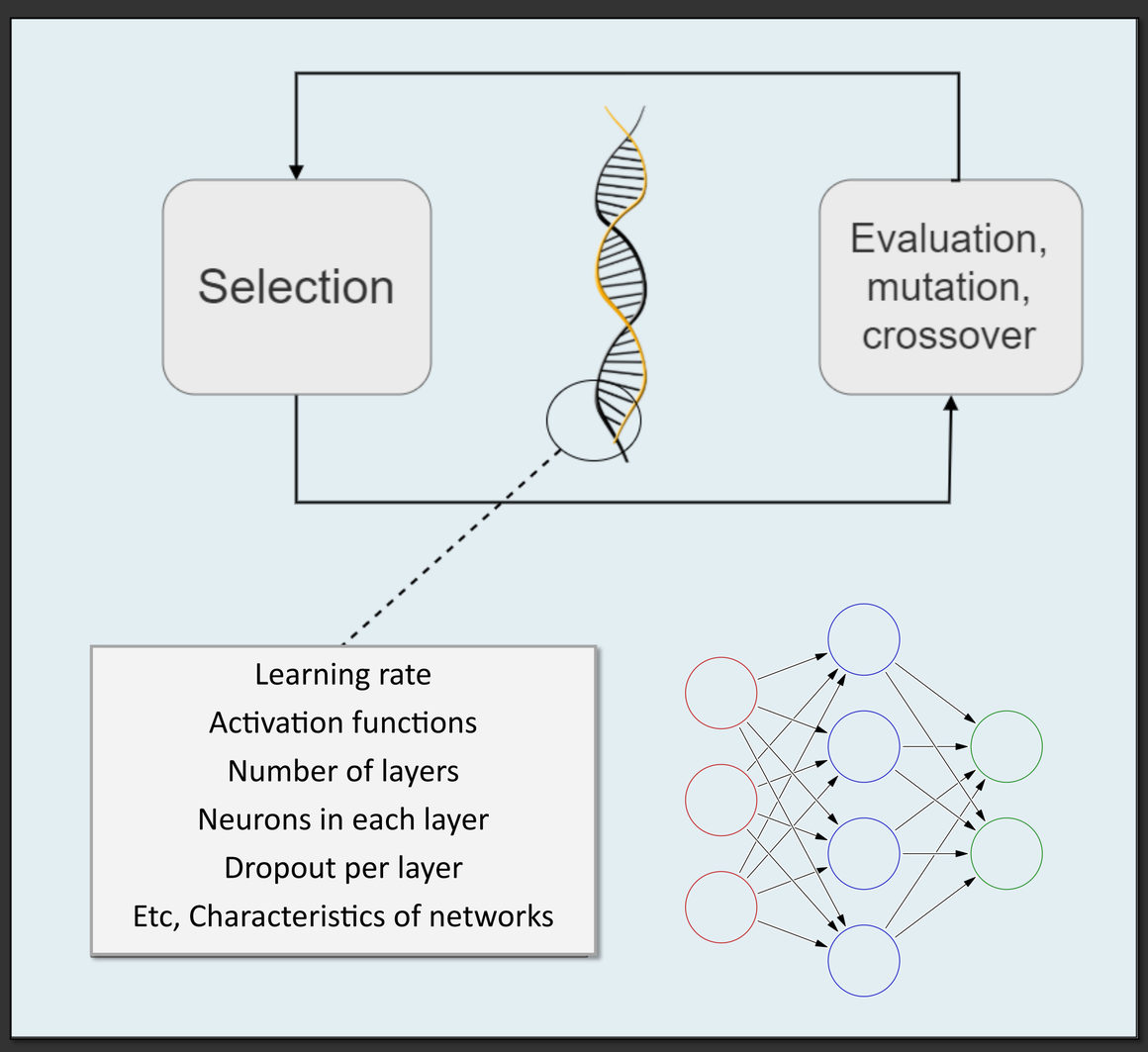
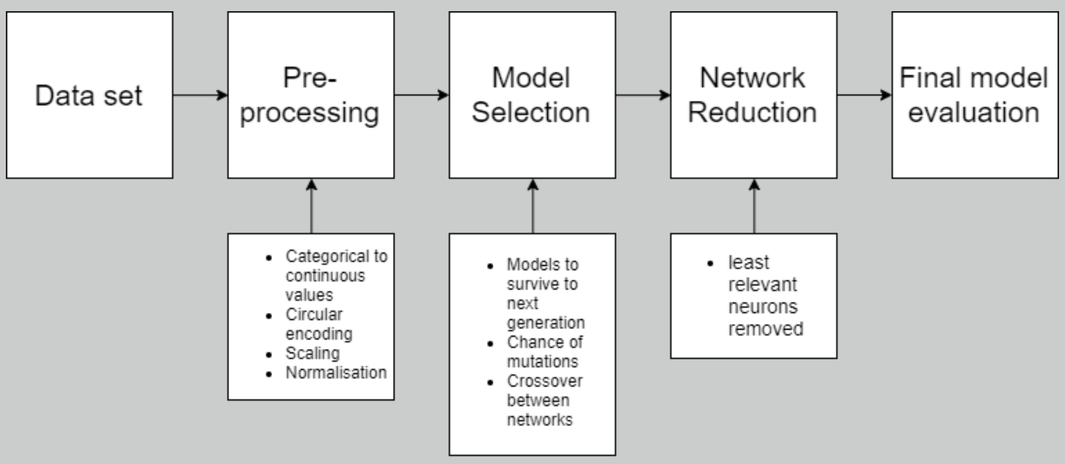
## Abstract

We define an evolutionary algorithm which selects all the hyperparameters of an ANN. To date, there has not been well-defined universal approaches to hyper-parameter selection ANNs We use our algorithm to generate a network for classifying core porosity classes of minerals based on qualitative descriptions.

Our preliminary results demonstrates that our algorithm produces results similar to the state of the art on this dataset. We plan on conducting further tests and evaluating our




## Methodology

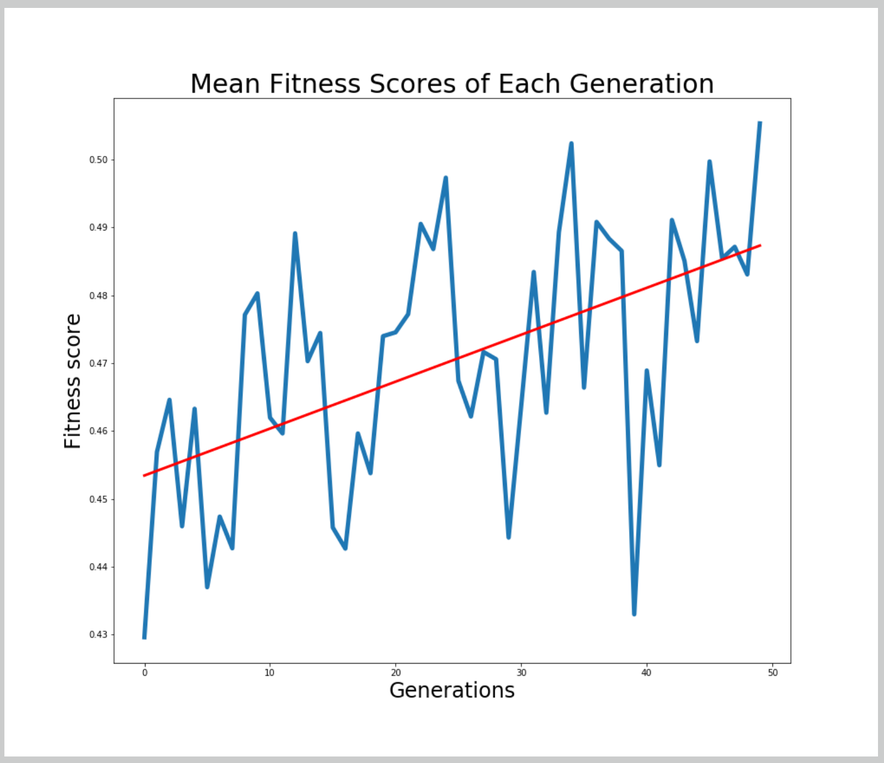



The pipeline of our methodology can be seen above. We pre-processed the data in a similar manner to past works with this dataset. We designed a method of mutating and crossing networks which involves selecting parameters from each. We then apply network reduction techniques to further enhance the quality of the models produced.

## Preliminary Results

Our fitness score consists of three randomly subsampled validation sets since our data set is small. We clearly see that our fitness evaluation is improving as our generation increases .

The final classification accuracy is comparable to networks which have hand tuned hyperparameters. We further improve them by applying network reduction techniques as a final set of heuristics to network improve generalization.




## Conclusion

We have demonstrated that our methodology works for tuning hyperparameters of networks for this given dataset. This warrants further research into applying and improving our methodology.

## Future Work

Improvements to our approach:

- More hardware/time for increased generations
- Improvements and fine-tuning our approach such as more possible adjustments to the hyperparameters (allow for mixing different types of layers and weights).

We plan on further demonstrating the validity of our approach by applying it to other datasets and applications. We also hope to compare it against other applicable Neural Architecture Search methods.