Knowledge Lab

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Self-Adaptive Hyperparameter Control For Deep Learning Neural Networks Using Cellular Automata

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Research Aims
The aim of the research is to automate the adaptation of Hyperparameters through the use of Cellular Automata controlled by a Governing Algorithm (GovAlg) which is used to analyse fitness and procure new parameters based on historic performance.

Furthermore, the research will also undertake to demonstrate change detection for dynamic environments in order to promote re-evaluation of the Hyperparameters. Change may be detected through means of periodic sampling, or triggered when error rate touches a given threshold.

Research Methodology
Our approach proposes the application of a governing algorithm (GovAlg) based on cellular automata to the detection and discovery of hyperparameter values of deep learning networks.

Prior to execution, an initial Generation (G0) is created by GovAlg. This is also the controller algorithm which evaluates the Cellular Automata which comprise the solution. G0 contains the sets of Hyperparameters we wish to evaluate to inform the next generation Subsequently, GovAlg evaluates and refines the Hyperparameters (Fig. 1).

Research Approach
The approach is tested on deep learning benchmarks, i.e. the MNIST database of handwritten digits, which comprises 60,000 examples with a test set of 10,000 samples. A Convolutional Neural Network is used to evaluate each image for classification. A modified instance of the LeNet implementation is used for the experiment.
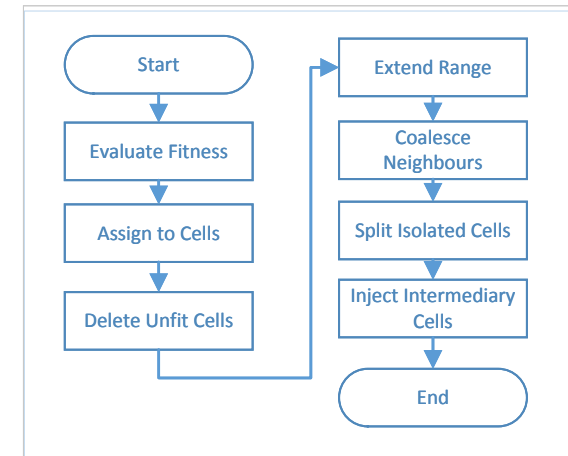

Figure 1. Governing Algorithm

Publications

- M. Kelly and G. Di Marzo Serugendo. "A Decentralised Car Traffic Control System Simulation Using Local Message Propagation Optimised with a Genetic Algorithm". In Engineering Self Organising Systems, 2007
- M. Kelly and G. Di Marzo Serugendo. "Decentralised Car Traffic Control Simulation Using Message Propagation Optimised with a Genetic Algorithm". In IEEE Congress in Evolutionary Computation (CEC 2007), in press, 2007.
- M. Kelly and G. Di Marzo Serugendo. "Decentralised Car Traffic Control using Message Propagation and Re-routing". In I TSC Intelligent Transportation Systems (ITSC 2007), in press, 2007.
- M. Kelly and G. Di Marzo Serugendo. "Decentralised Urban Traffic Control using Genetic Algorithm and Cellular Automata". (CEC 2008).