CSE208L Object Oriented Programming Lab
LAB # 3

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"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

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Evolving Deep Convolutional Neural Networks for Image Classification

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In this paper, we propose a new method using genetic algorithms for evolving the architectures and link important initialization values of a deep convolutional neural network to address image classification problems. In the proposed algorithm, an efficient variable-length gene encoding strategy is designed to represent the different building blocks and the potentially optimal depth in convolutional neural networks.

Since LetNet-5 was proposed in 1989 , which is an implementation of CNNs and whose connection weights are optimized by the Back-Propagation algorithm , various variables of CNNs have been proposed, such as VGGNet and ResNet .

Where X and Y are the input data and the corresponding label, respectively, F denotes the architecture choosing function for the given data, A is the resulted architecture, G refers to the initialization method of the connection weights W based on the chosen architecture.

Z denotes the resulted features learned by this CNN based on the input data X and the weights W. In the context of a classification task, a classifier is added to the tail of the CNN by receiving Z. The objective function of training the CNN is determined by the particular classifier based on Y .

In this regard, a variable-length gene encoding strategy may be the best choice for both 1) and 2), but how to assign the crossover operation for different building blocks is a newly resulted problem; and 3) the weight initialization values heavily affect the performance of the resulted architecture, but addressing this problem involves a good gene encoding strategy and the optimization of hundreds and thousands decision variables.

The aim of this paper is to design an effective and efficient GA method to automatically discover good architectures and corresponding connection weight initialization values of CNNs without manual intervention.

The involved parameters in one convolutional operation include the filter width, the filter height, the number of feature maps, the stride width, the stride height, the convolutional type, and the connection weight in the filter.

Because of the numerous connection weights in CNNs, it is not necessary that all the connection weights start with the same values, which is the known major deficiency of the initialization methods in the first category.