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Evolutionary Convolutional Neural Networks: an Application to Handwriting Recognition

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Abstract

Convolutional neural networks (CNNs) have been used over the past years to solve many different AI problems, providing significant advances in some domains and leading to state-of-the-art results. However, the topologies of CNNs involve many different parameters, and in most cases, their design remains a manual process that involves effort and a significant amount of trial and error.

In this work, we have explored the application of neuroevolution to the automatic design of CNN topologies, introducing a common framework for this task and developing two novel solutions based on genetic algorithms and grammatical evolution. We have evaluated our proposal using the MNIST dataset for handwritten digit recognition, achieving a result that is highly competitive with the state-of-the-art without any kind of data augmentation or preprocessing. When misclassified samples are carefully observed, it is found that most of them involve handwritten digits that are difficult to recognize even by a human.

Keywords: neuroevolution, evolutionary algorithms, convolutional neural networks, automatic topology design, genetic algorithms, grammatical evolution

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