CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S1511

Project Title

Artificial General Intelligence: Efficient Reinforcement Learning to Achieve Human-Like Reasoning

Abstract

Objectives/Goals

Artificial neural networks suffer from a phenomenon known as "catastrophic forgetting", which prevents artificial intelligence agents from learning multiple tasks. This project explores various network structures and training methods to deal with this barrier to achieving general intelligence.

Methods/Materials

Used Python programming language with Theano and Keras libraries. Various unconventional artificial neural network structures were assessed on tasks such as object recognition and cursor navigation based on training speed and resilience.

Results

The traditional sequential models demonstrated catastrophic forgetting to a large extent, achieving over 90% accuracy on one task but under 10% on the other. Meanwhile, a sequential model trained simultaneously on both tasks reached only 50-60% accuracy. However, progressive or 2-column neural networks improved about 20% on this benchmark. There was a significant increase in performance and training efficiency.

Conclusions/Discussion

Progressive neural networks are an efficient way to improve AI performance on multiple tasks. They can be easily extended to encompass more than two tasks, through the use of multiple columns, or subnetworks. Choosing the output (since PNNs create multiple outputs) is a trivial task that may be left to a separate machine learning model. With learning models such as the PNN, the issue of catastrophic forgetting is no longer a major obstacle in achieving general intelligence.

Summary Statement

I explored various training techniques and artificial neural network models to improve model resilience when given more than one task to learn.

Help Received

None. I designed and wrote all the programs myself. I used the Keras and Theano scientific computing libraries in Python.