Enhanced POET: Uber AI Labs

The Enhanced POET: Open-ended reinforcement learning through unbounded invention of learning challenges and their solutions was written by the team at Uber AI labs. This team included Rui Wang, Joel Lehman, Aditya Rawal, Jiale Zhi, Yulun Li, Jeff Clune, and Kenneth O. Stanley. They worked on this to improve the POET model, hence the name, enhanced poet.

<https://arxiv.org/pdf/2003.08536.pdf>

<https://www.youtube.com/watch?v=jxIkPxkN10U>

**Enhanced POET**

* Designed at Uber AI Labs
* Coevolution between the learning agents and the environments they learn in.
* Optimize and have a diverse set of solutions
* Known as a quality diverse problem.
* Maps from 24 inputs
* 2 Layers of neural network representations
* Creates 4 outputs

Population built algorithm

When you have a new environment, if the new agent is better, then the POET is going to switch over to the new environment when testing.

4 Changes to enhanced poet

* PATA-EC
* Transfer Algorithm
* CPPN-EE (Environment Encoding)
* ANNECS Measure of Progress

PATA -EC

* As you evolve a new environment, we evaluate the performance and we determine the effect, and then decided if it needs to be added to the new environment.
* Steps
  + Evaluate: Each environment evaluates all active and archived agents and stores their raw scores in a vector
  + Clip: Each score in the vector is clipped between a lower and upper bound
  + Rank Normalize: Replace scores with rankings and normalize ranks in the range of [-0.5, 0.5] to allow use of Euclidean distance to measure PATA-EC

Transfer Algorithm

* If the score exceeds the threshold, you would then do a fine tuning and then if it improves then you add it to the other environments

CPPN-EE

* Neuro Evolution of topology adding new nodes to the topology and mappings it to the output pattern
* Paper: Compositional Pattern Producing Networks: A Novel Abstraction of Development by Kenneth O.Stanley

ANNECS

* How can we tell whether a system continues to generate interesting new things?
  + Track the accumulated number of novel environments created and solved

Experiment # 1

PATA-EC can produce the same diversity as hand-designed EC

Requiring 82.4 +- 7.31% more computation

Original EC was hand-designed for this specific domain, whereas PATA-EC is more general and enables more complex EE’s

Experiment #2

Creates and solves the same diversity and challenges levels of environment with only 79.7 +- 1.6% of the computation