A general characteristic of simple programs that are able to learn complex behaviors

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1   Question

Is there a general characteristic of simple programs that are able to learn complex behaviors, such as neural network or RL-based algorithms that can be implemented in less than 100-250 lines?

2   Answer

I don't know yet.

This question has come after thinking about DNA as being the code of human beings. DNA is also part of other animals, even viruses. Organisms use nucleotides to store the programs that are necessary to their existence. DNA is used to produce proteins within the body that accomplish various functions such as regulating our body, controlling our mood, our attention, our hunger, etc.

This code has evolved since we were non-biological. From a large amount of randomness (chemical elements), nucleotides were formed, which then somehow led to the formation of DNA itself after a likely long process. If through randomness we moved from a chaotic world to one with order and structure, and where a chain of DNA could finally emerge, it would be interesting to investigate the process in further details to determine whether it could give us clues regarding the process of creating a program that could evolve the same way DNA did.

Cellular automaton are also interesting to study in that aspect. By defining a small set of rules, it is possible to generate and observe complex behaviors.

One common behavior of cells is that they reproduce. As such, I would expect a program that can learn complex behaviors to have some reproductive function. Reproduction is considered as one of the traits of an entity being alive. My idea here is that exploring how we were able to massively populate the Earth may provide us with ideas on how a bit of code learned to lengthen itself, by the same process increasing the size of its host as well as the complexity and variety of cells that compose it.

3   References

- Genetics based AGI
- Theory of self-reproducing automata
- Seed AI
- RNA world
- Abiogenesis
- Cellular automaton
- Conway's Game of Life
- A New Kind of Science
- John Von Neumann - Theory of self-reproducing automata