Artificial Intelligence Workshop

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1 Evolai: An Evolutionary Approach to AI

1.1 Theory

C. E. Shannon, “Prediction and Entropy of Printed English,” *Bell Sys. Tech. Jour.*, Vol. 30, pp. 51 – 64, 1951.
Human beings have an amazingly good ability to predict text. Our knowledge of the workings of our brains in necessarily high-level, and at this level we know our brains by interacting with them. If a computer program can interact like a human being, we must call whatever goes on within the program, however alien it may look, consciousness. Furthermore, if a computer program can predict human behavior as well as a human being can, it can “predict” it’s own behavior and achieve consciousness.

Rather than decide on any particular structure for the underlying program, programs can be randomly generated based on their ability to predict human behavior.

Process:

1. Randomly choose a previous set of instructions (DNA) and make a copy, introducing small errors (change an instruction, add an instruction to the end, remove an instruction from the end).
2. Randomly grab a file from the internet and execute the instructions in the DNA to predict characters. A special DNA instruction will “make a prediction” by proposing a single byte as the next character in the file, then the program will be given access to the actual next character. The DNA is run for N predictions or to the end of the file, whichever comes first.
3. Add the number of successful predictions to the score. If the DNA has not had the chance to make N predictions, reset the DNA and return to the previous step.
4. The score is now a measure of the programs ability to predict human behavior. That set of DNA may now form “offspring” sets of mutated DNA equal to its score. Return to the first step.

2 Copycat: Mental Fluidity and Analogy-making

2.1 Theory

Mitchell, Melanie. *Analogy-Making as Perception: A Computer Model.* MIT Press, Cambridge, 1993.
Hofstadter, Douglas and the Fluid Analogies Research Group. *Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought.* BasicBooks, New York, 1995.
Human thought, knowledge, and perception is necessarily structured, and one necessary form of those structures in analogies. Real-world analogies involve too much random knowledge, but the fundamentals of analogy-making can be explored in a play world consisting of conceptually sophisticated but syntactically simple letter analogies. The Copycat program was developed with 5 target analogies in mind: abc $\Rightarrow$ abd, ijk $\Rightarrow$?; abc $\Rightarrow$ abd, iijjkk $\Rightarrow$?; abc $\Rightarrow$ abd, kji $\Rightarrow$?; abc $\Rightarrow$ abd, mrrjjj $\Rightarrow$?, abc $\Rightarrow$ abd, xyz $\Rightarrow$?

2.2 The Three Major Components of the Copycat Architecture

2.2.1 The Slipnet - Copycat's network of Platonic concepts

Consists of a, b, c ..., z, letter, successor, predecessor, alphabetic-first, alphabetic-last, alphabetic position, left, right, direction, leftmost, rightmost, middle, string position, group, sameness group, successor group, predecessor group, group length, 1, 2, 3, sameness, opposite

Major aspects:

- Nodes have Conceptual Depth
- Activation flow through variable link-lengths
- Concepts as diffuse, overlapping clouds

2.2.2 The Workspace - Copycat's locus of perceptual activity

Area in which the original problem "lives" and the various conceptual groupings and problem interpretations apply. Conceptual structures slowly build up and eventually some becomes strong enough to eliminate incompatible structures.

Major aspects:

- Constant fight for probabilistic attention
- Parallel emergence of multi-level perceptual structures
- Drive towards global coherence and towards deep concepts

2.2.3 The Coderack - Source of emergent pressures in Copycat

Everything change and evaluation for a possible change is done by small program aspects called "codelets." Codelets are randomly selected based on their salience to make progress in different directions, first making short estimates of potential, then forming conceptual structures in the Workspace.

Major aspects:

- Pressures determine the speeds of rival processes
- Shifting population based on progress
- Compromise between depth-first and breadth-first searching

3 Perpetual Evolai and Metacat

Can these two approaches be combined?

3.1 Perpetual Evolai

The theory of Memes says that individual concepts are like entire communities of Evolai "organisms". Rather than trying to generate a single intelligent program, can generations of Evolai organisms compete over predicting overlapping sets of "real-life" data?

Major flaw: Evolai have no memory across generations (intentionally).

3.2 Metacat

Rather than deciding on set networks of concepts, pragmatically concepts like "opposite" and "successorship" exist because of the contexts within which they are used. The Slipnet and the Workspace might be combined as incoming data of arbitrary types is introduced byte-by-byte, linked only to other temporally close pieces of data.

Major flaw: The codelets necessary to form structures are unpredictable.

3.3 The Next Step

Can these two approaches be combined, compensating for each other's flaws and helping each other's progress?