ICARUS, Subsumption and Connectionism

Adrian Langseth

Okotber 2019

1 ICARUS

1.1 Describe the Conceptual Inference process

The conceptual inference starts in the percepts. The primitive beliefs are inferred from a combination of one or more percepts. Higher level beliefs are inferred from only beliefs, either primitive or higher-order.

1.2 What is the relation between a goal and a skill?

Goals must refer to defined concepts and skills. A goal is defined by the skill it uses, and the skills are either defined by the action it implements or its subgoal.

1.3 How can Icarus learn from its problem solving behaviour?

When Icarus encounters previously unseen concepts and situations, ICARUS chains backward through skills it has, and creates new subgoals. When it has completed the problem-solving, it creates a new skill for the situation of in which is contained the skills it uses to reduce the problem to a primitive one and then uses the primitive skills to cap off the problem.

2 Connectionism

2.1 What does the term 'connectionism' mean to you, and why is the term used in relation to artificial neural networks?

In my understanding the word connectionism is the usage of several objects which do their own work, connected together to do something greater than the sum of its parts. The term is used in relation to artificial neural networks because of the way artificial neurons each do their own processing in parallel, as well as the way it uses the processing is not based on logical rules.

2.2 Connectionist architectures are claimed to be based on how the physical brain works. What does 'based on' mean here?

The architecture is based on the usage of artificial neurons. These are built with inspiration in the neurons in the human brain. Connectionism architectures are a interwebbed system of artificial neurons, much as the actual brain is an interwebbed system of neurons.

2.3 What in an artificial neural network are strongly linked to (what we know of) a biological neural network, and what are not?

Strongly linked:

- Artificial neurons
- The boolean nature of the neurons
- The weighting of signals is linked to the strength of a synapse.

Not linked:

- The backtracking ability
- The direction-oriented structure. Where one layer is only connected to the previous and next layer.

2.4 Would you say that 'deeplearning' is modelled on the way humans learn?

Partially, the reasoning aspect of it mimics the human learning, however most learning a human does is assisted by some form of guide, whether this is a book or another human. It gets much of its learning by being told what the characteristics of a concept is, not solely from deep-learning styled self-reasoning.

3 Perceptron

3.1 Explain how the run-function is built up. What are the functions "activation" and "weight-training" doing?

The run function starts by setting a set of default weights. The until its weight converge, the weights are checked for error and trained.

The weight_training function takes in the set of current weights, and generates new weights based on the error. It the returns the new weights for use by the run function.

The activation function is the fucntion which concerns itself with the activation of the perceptron. It applies the weights to the input at uses a step function to get the weight-determined output.

3.2 The function "initialization" is not used in the main or run - function. What is the function doing, and how could it be used in this task?

The initialization function initializes a random set of weights, and a random threshold. It could be used in the main rather than initializing the weights and threshold explicitly.

3.3 Run the code (main already made for you) and explain the results.

The output shows the 7 epochs it went through to arrive at the weight which give the desired output. It inches toward the functioning weights by the weight training. It ends by realizing the weights are converging and the tells us this before finishing.

4 Subsumption

4.1 Many cognitive architectures make use of an explicit model of the world to be used for cognitive tasks, e.g. problem solving and learning. Does that also include Brooks' Subsumption Architecture?

Brooks Subsumtion Architecture makes use of the belief that the user should use parallel processing and the decomposition of goals into task achieving behaviours instead of functional modules. Brooks claims that the world is its own best model, meaning proper perception-to-action setups can be used to directly interact with the world instead of modelling it.

4.1.1 How does this architecture relate to the Physical Symbol Systems Hypothesis and the Heuristic Search Hypothesis?

The Physical Symbol Systems Hypothesis says that "A physical symbol system has the necessary and sufficient means for general intelligent action". Subsumption does however not use a physical symbol system, which makes it hard for the implemented mobile robot to understand language.

This architecture's subsumption relates to the Heuristic Search Hypothesis as by allowing higher layers to subsume the lower layers it can expand on decision branches which are deemed more likely to produce the correct action.

4.2 Describe the layered structure of the Subsumption Architecture. How are the layers related to each other, how are their dependencies? How are the layers linked to sensor data in and actions out?

The subsumption architecture is layered in the sense that it is composed of layers, each which adds complexity and a new task achieving behaviour. The levels are not dependant upon each other but are connected, as the higher level behaviours can subsume the lower layers. Layers are each connected to the necessary sensor data for their task, and all give some output if need be. However, higher layers can subsume lower layers.