Digital Spikes: Information Representation in ATR's CAM-Brain Machine

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Abstract:

This paper describes ongoing ATR's CAM-Brain Project, which is an attempt to build large-scale neural networks ('artificial brains') in a special hardware called "CAM-Brain Machine" (CBM). At the time of writing (March 1998), the project is making efforts on two fronts - the construction of the CBM, that is scheduled to be operational in the summer of 1998, and attempting to find an efficient and effective representation for the binary signaling of ATR's CAM-Brain Machine (CBM), using the so-called "CoDi-1Bit" model. The CBM is an FPGA based hardware accelerator which updates 3D cellular automata (CA) cells at the rate of 100 billion a second, allowing a complete run of a genetic algorithm with tens of thousands of CA based neural net circuit growths and hardware compiled fitness evaluations. It is hoped that by using such a device, it will become practical to evolve 10,000s of neural net modules and then assemble them into humanly defined RAM based artificial brain architectures which can be run by the CBM in real time to control robots, e.g. a robot kitten. Before large numbers of modules can be assembled together, it is essential that the individual modules have a good functionality and evolvability. The "CoDi-1Bit" CA based neural net model uses 1 bit binary signaling, so a representation needs to be chosen based on this fact. This paper discusses the merits and demerits of a representation that we call "Spike Interval Information Coding" (SIIC).

KEYWORDS: Large-scale artificial neural networks, evolutionary neural networks, CAM-Brain

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• The Spike Interval Information Coding (SIIC) Representation
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