POETS: Reliability, Self-discovery, Domains of application....

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Abstract:

In Seminar I, we talked about the general concepts of event-based simulation. In Seminar II, event-based simulation of neural circuits using SpiNNaker were described, illustrating *how* it does *what* it does. In the third talk, we described the physical structure of another event-based architecture, POETS, and went into some detail about how it could be use to synthesize *realistic* neural ensembles using a technique called diffusion limited aggregation.

In this final seminar, we discuss a variety of topics closely allied to event-based computation:

- We show - in some detail - how a typical real physical problem - in this case, the heat equation - can be solved using event-based techniques. Yes, there will be differential equations.

- Reliability: we show how the solutions obtained in the previous section can degrade gracefully in the face of increasing machine trauma: more and more of the machine is disabled (far beyond what would be reasonable in reality) and the answers are still recognisable. How many wires can you cut in a desktop PC and still expect it to function?

- We discuss how a large, distributed machine with no central overseer can self-discover its own topology, and effectively bypass parts of its own fabric it identifies as faulty. This is essential when the machine is being configured, but the techniques are so lightweight that they may be overlaid upon "real" computation, effectively running in the background. Whilst there is little (but not nothing) that can be done to ameliorate the effects of a dynamic fault, the machine is at least able to indicate areas of the solution space in which it has diminished confidence.

- Finally, we present a brief overview of just some of the array of application domains that we have identified as benefitting from the event-based computing idea, maybe lingering a little too long on the electron beam proximity correction problem, because it's so interesting.

Finite elements
System simulation (discrete and continuous)
Computational chemistry
Neural simulation
Weather modeling
Ray tracing
Behavioral electronic synthesis
Financial market modeling
Genome searching
Anything with a matrix in it
Image analysis