Human Brain Project

The University of Manchester

SpiNNaker

School of Computer Science, The University of Manchester, UK

A pioneering brain-inspired neuromorphic computing platform

TECHNOLOGY DESCRIPTION

SpiNNaker – a contraction of Spiking Neural Network Architecture – is a massively-parallel brain-inspired neuromorphic computer for large-scale real-time brain modelling applications. It has three aims:

- to simulate very large brain-like networks, to advance our understanding of how the brain works;
- as a real-time neural simulator that allows roboticists to design large neural networks, that are both flexible and low power, into mobile robots;
- to question the restrictions that we impose on our computer architectures, by comparing them to the very different principles evolved by nature in the brain.

Simulations employing massively-parallel spiking neural networks that mimic the functioning of a brain are run as tools for both computational neuroscientists, to help understand how the brain works, and roboticists, to design large neural networks into flexible, low power robots

More than 1 Million processors in 1200 boards allows large-scale real-time brain modelling simulations without buying time on a supercomputer

AREAS

Computing | Robotics | Computational neuroscience | Theoretical neuroscience

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COMPETITIVE ADVANTAGES

- **Flexibility:** the use of software to model neuron and synapse dynamics allows new theories to be explored rapidly
- **Scale:** with a million processors, each capable of modelling several hundred neurons and several million synapses, real-time models up to full mouse-brain scale are possible
- **PyNN:** a standard spiking neural network description open-access language allows rapid user access with minimal training
- **Research and development**: next SpiNNaker generation will deliver 10 times the computer performance while consuming about the same power as the original chip.

SpiNNaker is the largest neuromorphic computing platform in the world today

APPLICATION & MARKET POTENTIAL

SpiNNaker can be used as a development platform for:

- **Event-based machine learning** for energy-efficient AI, for example in mobile platforms;
- **Large-scale brain models**, to understand brain function and ultimately, perhaps, to model the effects of drugs;
- **Neuro-robotic con**trol systems for compliance and user safety;
- **Novel learning algorithms** for event-based machine learning.

TECHNOLOGY READINESS LEVEL

1 2 3 4 5 **6** 7 8 9

REFERENCES

- Around 100 SpiNNaker systems are in use in labs around the world, including US, Japan, Australia and New Zealand
- The University of Manchester built the world's first operational stored-program computer, which ran its first program on June 21st 1948
- Alan Turing wrote his 1950 paper on "Computing Machinery and Intelligence" when at Manchester, introducing the Turing Test for human-like AI – still not passed by any machine!

CONTACT

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