FACETS: Fast Analog Computing with Emergent Transient States

Common Goal: Study Non-classical Universal Computing Solutions
Benchmarking (Biology vs. Modelling vs. Hardware with Visual Tasks in Vl)

Tool Development (Computing, VLSI)
Reduction of Biological Detail / Complexity

Modelling: Virtual Microcircuits on State-of-the-Art Computers
Hardware: Emulation in Analog and Mixed-signal VLSI Systems

Neurobiology: Structural and Functional Investigation of the Neocortical Microcircuit and the Circuit Elements In-vivo and In-vitro

Contemporary IT systems
- Processor-memory based architectures with serial command execution (Turing)
- Pre-determined algorithms define capabilities and performance (software)
- Based on well defined reproducible states and well defined reversible time evolution
- Electronics implementation of Boolean operators, high power consumption
- Extremely high yield requirements, little fault tolerance
- Limited by atomic distance scale in components (nm): component limited

→ WELL UNDERSTOOD

Neural computation
- Maximally parallel, non-linear computing elements with large diversity
- Time correlations drive the dynamics
- Learning by internal self-organisation and strong interaction with environment
- Low power consumption and high fault tolerance
- Limited by degree of complexity: architecture limited

→ NOT UNDERSTOOD (listed as a major challenge for 21. century science)