Optimum Microarchitectures for Neuromorphic Algorithms

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Introduction
Current computing systems excel at a variety of applications such as scientific simulations. However, they perform poorly at cognitive tasks such as learning, vision, and language. Humans excel at these tasks. There is a strong push currently to design computing systems that perform computations similar to the human brain.

Algorithms and Method
• Two new brain inspired compute algorithm: Izhikevich and HMAX
• Develop and parallelize the HMAX source code to multi-threads process
• Use GEM5 processor simulation software to design a high performance computing system
• A high performance compute cluster: UD Simulation Platform

Result

Conclusion
• Examined two classes of neuromorphic algorithms.
• Developed parallel implementation of HMAX. Determined single core architecture for each.
• Examined memory bandwidth impact on multicore architecture

Future Work
• Examine the HMAX algorithm with multicore system
• Examine other spiking neuron models
  -- Hodgkin Huxley
  -- Wilson
  -- Morris Lecar
• Examine detailed multicore architecture options

UD Simulation Platform

HMAX Flow Chart