SAND2024-10756C

Sandia University Partnerships Network
UNIVERSITY OF TEXAS AT AUSTIN

SANA-FE:
Simulating Advanced Neuromorphic Architectures for Fast Exploration

Presented by

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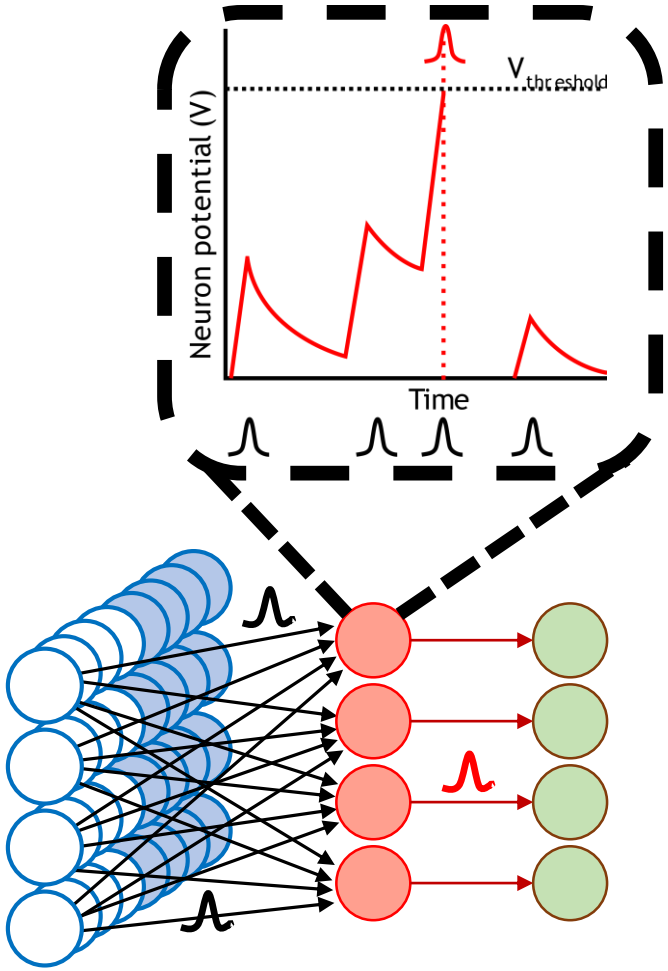
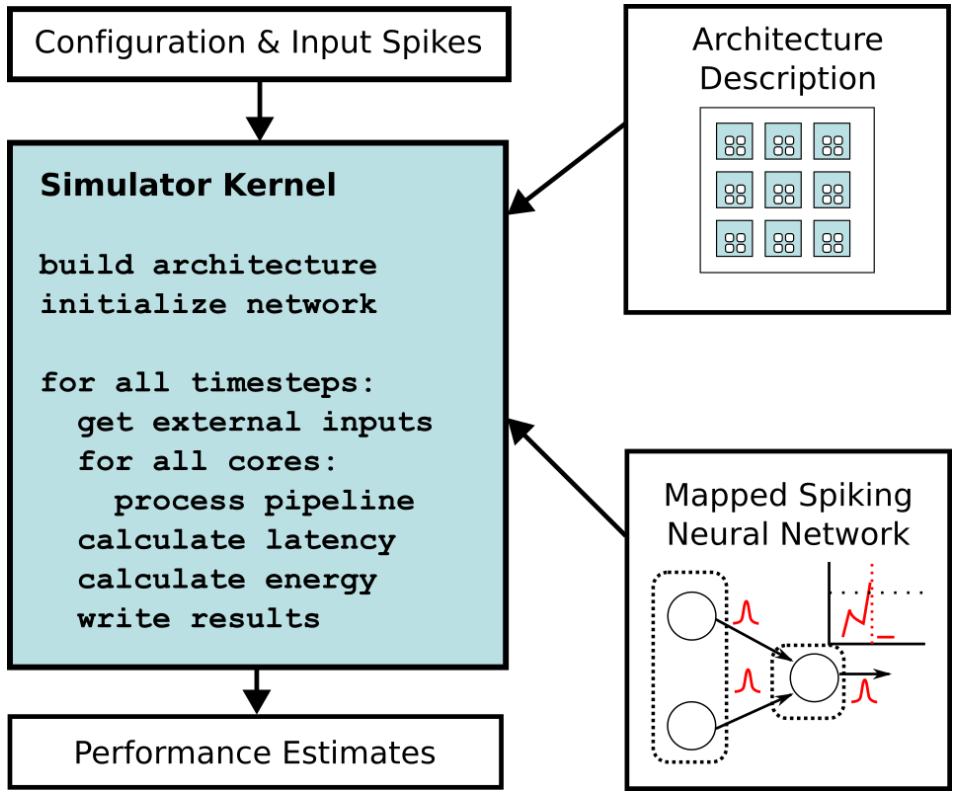
Introduction:
Purpose, Motivation and Impact

- Neuromorphic computing
  - Brain-inspired, power-efficient & noise tolerant
  - Embedded ML, brain-inspired algorithms, edge computing
  - Spiking neural networks (SNNs)
- Novel neuromorphic architectures
  - Scaling & richer dynamics
  - Incorporate latest neuroscience research
- Our objective
  - Rapid codesign & exploration
  - Modeling & benchmarking of performance and energy
  - Need for fast & accurate performance simulator



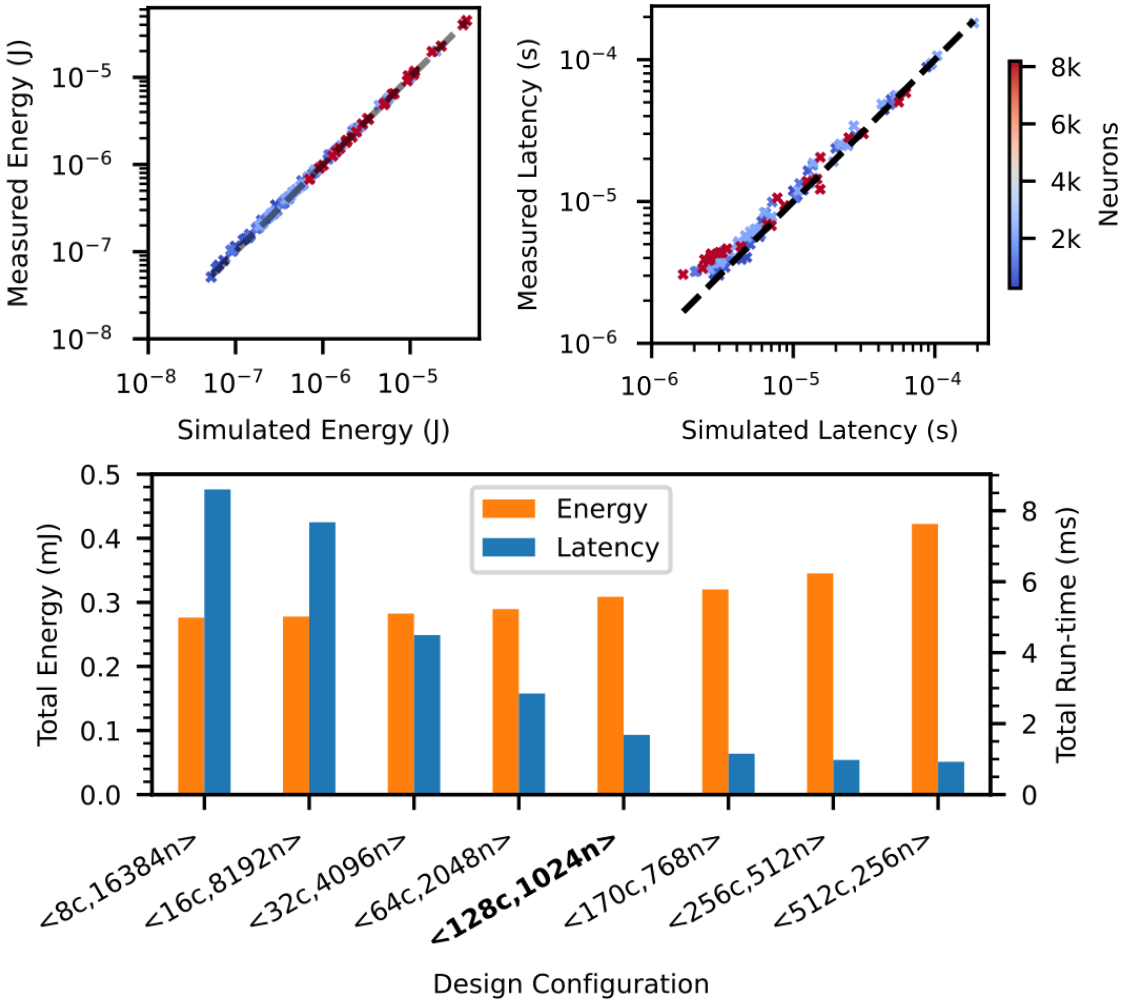
Approach

- SANA-FE: Simulating Advanced Neuromorphic Architectures for Fast Exploration
  - Neuromorphic architecture simulator
- Custom architecture & SNN formats
  - Flexible & extensible
- Coarse-grained time-step-based simulation
  - Fast & accurate
- Detailed performance output
  - Estimates energy & latency
  - Spike traces & H/W insight



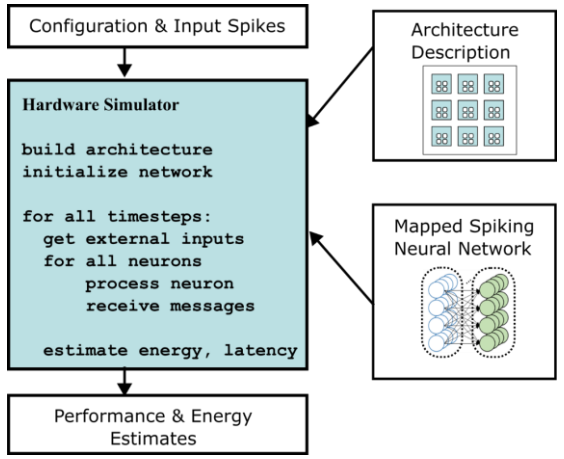
Current Status: Successes, Challenges, Risks

- Accurately & rapidly estimate performance of future hypothetical chips
  - Predicted latency & energy within 25% & 12%
  - Simulated 1.9M spikes/s
- Rapid early design-space exploration
  - New architectures, novel circuits & devices
- SANA-FE public & open-source release
  - Introduced at ICONS 2023
  - Tutorials at NICE 2024, ICONS 2024, ESWEEK 2024
  - Journal paper in review



Next Steps and Future Work

- Neuromorphic circuit & device plugins
  - Plugin library
  - ML-based surrogate modeling
- General simulator improvements
  - Parallelize SANA-FE
  - UI & scripting support
- Neuromorphic tooling ecosystem
  - Compilers & mapping
  - Neuromorphic architecture search
  - Fugu, SST & Intel Lava integration

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Questions?