

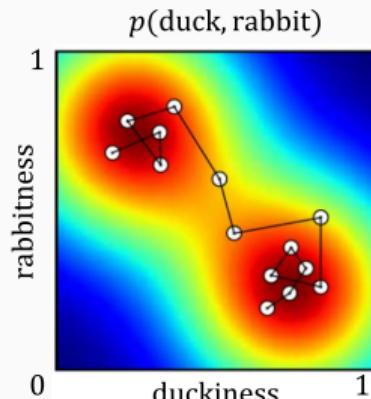
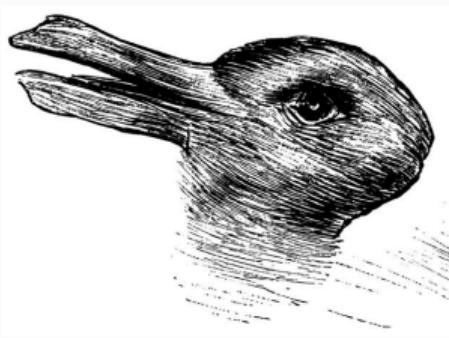
Self-sustained probabilistic computing on spike-based neuromorphic systems

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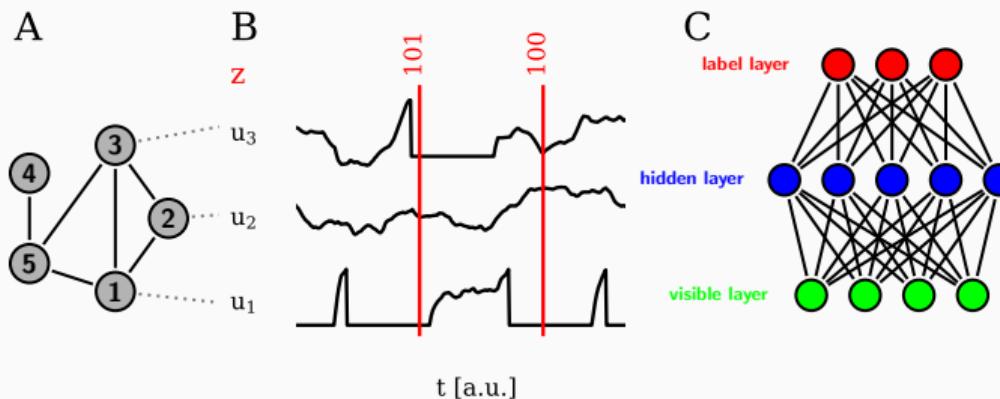
Probabilistic models



- neural activity is inherently noisy
- noisiness is interpreted as a probabilistic computation

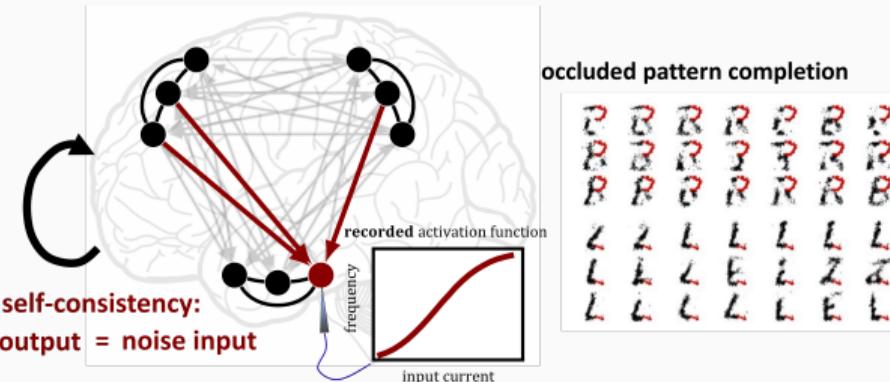
Berkes et al. (2011); Orbán et al. (2016)

Sampling with spiking neurons



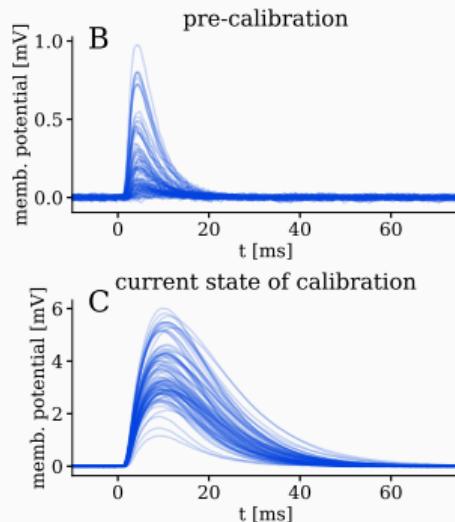
- interpreting dynamics as sampling
- spikes define the state
- useful for neuromorphic hardware

Sampling with deterministic neurons



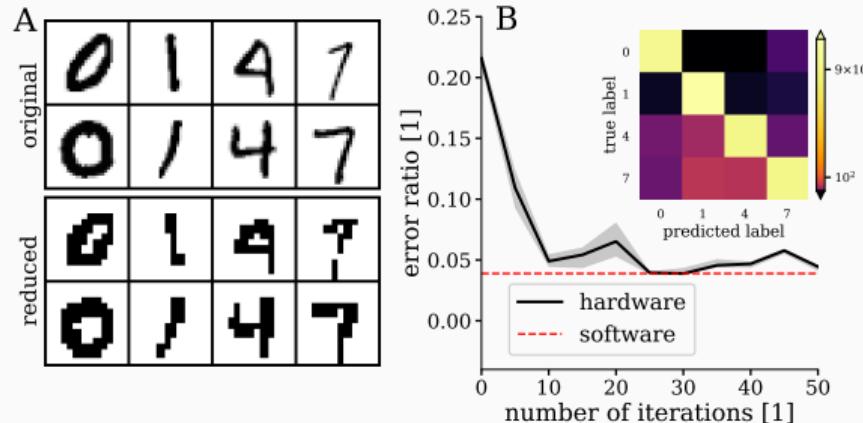
- no need for explicit noise
- independent functional networks feed each other with noise
- self-sustained deterministic system

The BrainScaleS-1 neuromorphic system



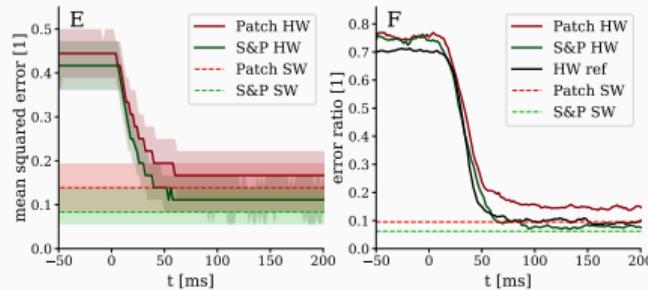
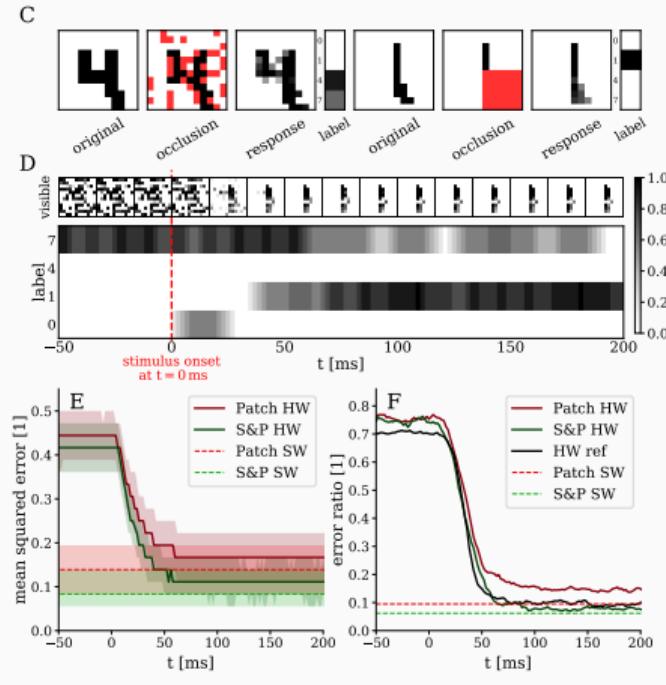
- mixed-analog signal hardware
- 200k neurons and 40 million synapses
- 10^4 -fold acceleration

Application on neuromorphic hardware



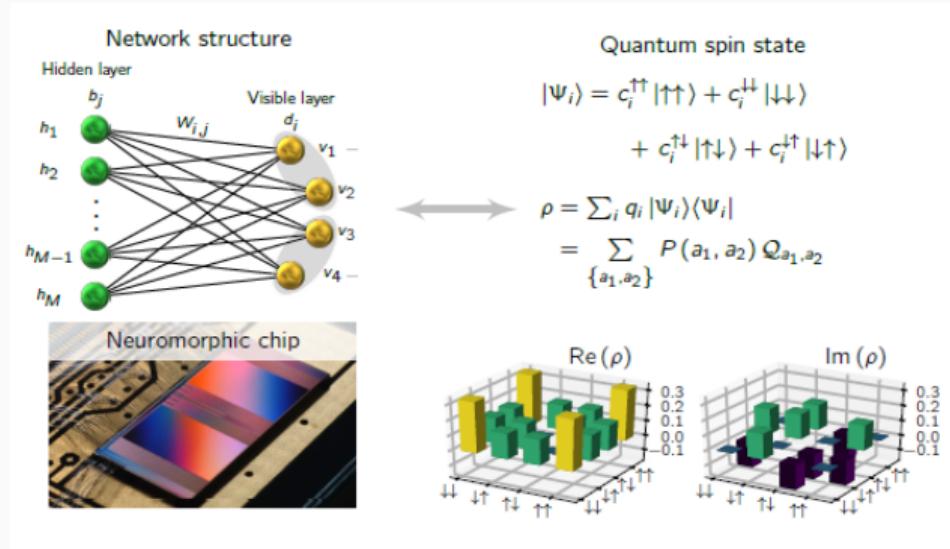
- in-the-loop training
- inference, pattern completion and data generation
- 2×10^5 images per second throughput

Application on neuromorphic hardware



- in-the-loop training
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Outlook and ongoing work



- quantum many-body problems
- spike-based on-chip learning
- connection to experiments

People behind the publications



Contact us to get access to the hardware!

<https://www.humanbrainproject.eu/en/silicon-brains>



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