A very brief overview of

Spiking Neural Networks

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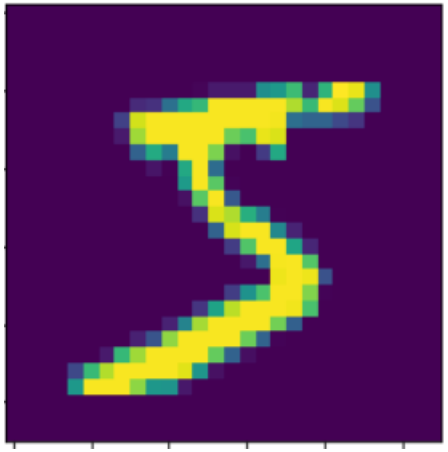
Order or chaos?

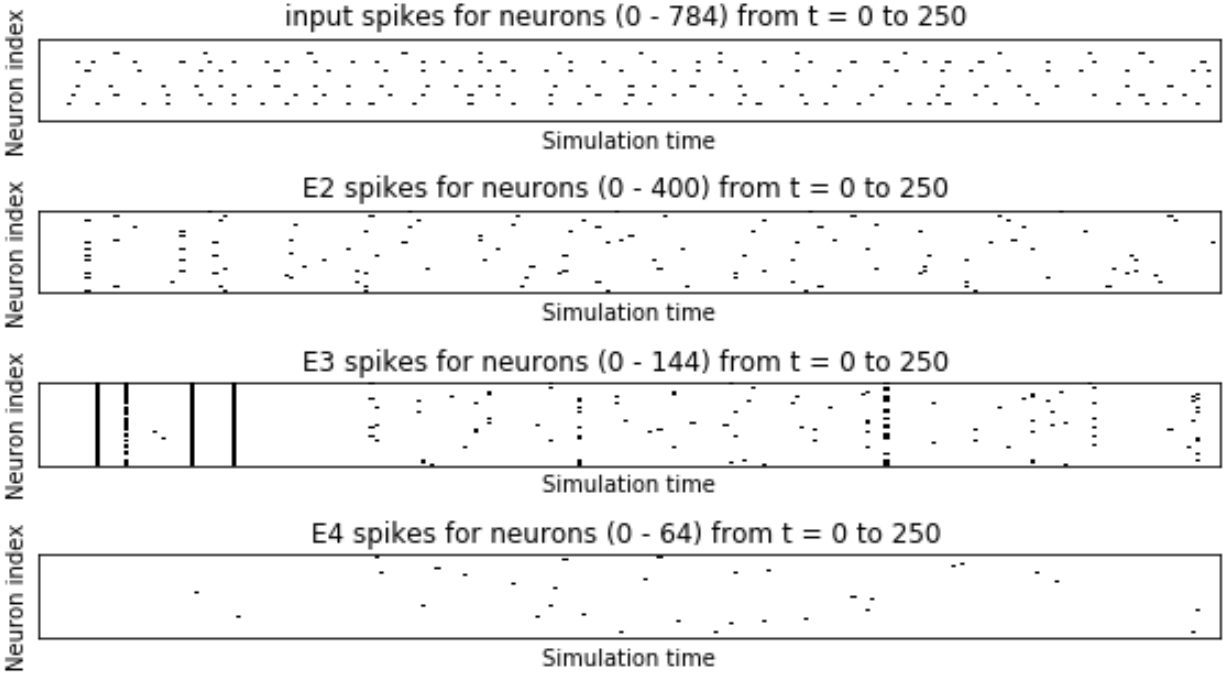


Input Layer 1

Fully Connected Layer 2

Fully Connected Layer 3

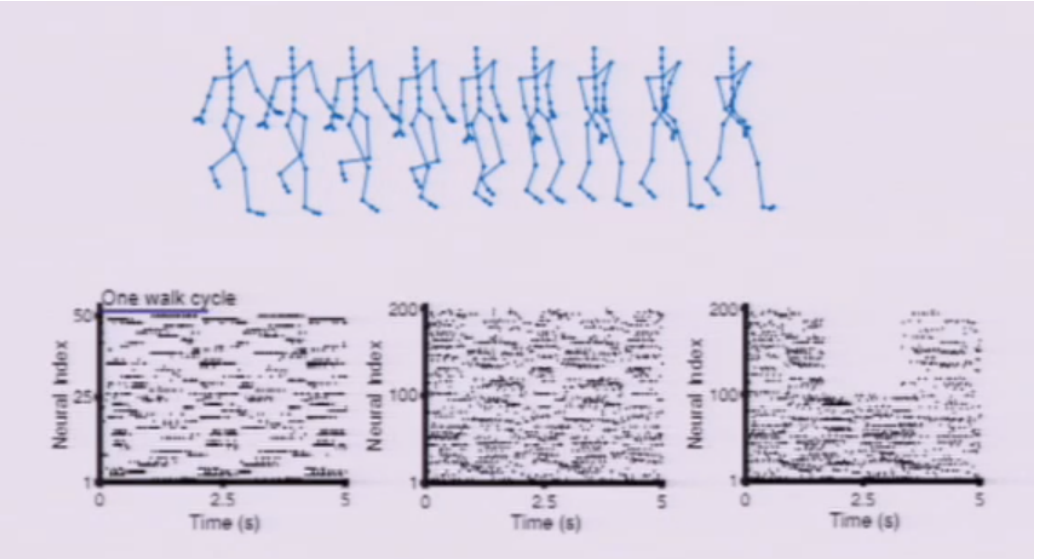
Fully Connected Layer 4



Why bother?

1. Lower power (Neuromorphic Chips)
2. Learns faster
3. Adaptable during operations
4. Asynchronous
5. No overfitting (Deneve 2017)

Resilient



S. Deneve 2017 Talk “The brain as an optimal efficient adaptive learner”: https://www.youtube.com/watch?v=41xH-rmHF6g

- Spiked
  - Training includes local learning
  - Trained network is adaptable
- Non-spiked
  - Training requires global knowledge
  - Trained network is a discreet state machine (inflexible)

What can you do with it?

- Speech interpretation in a small, low power package
  - Dominquez-Moralez et al. 2018
- Object recognition from video in small, low power package
  - Cao et al. 2014
- Sensor interface immune to device variations
  - Querlioz et al. 2013

Where to start?

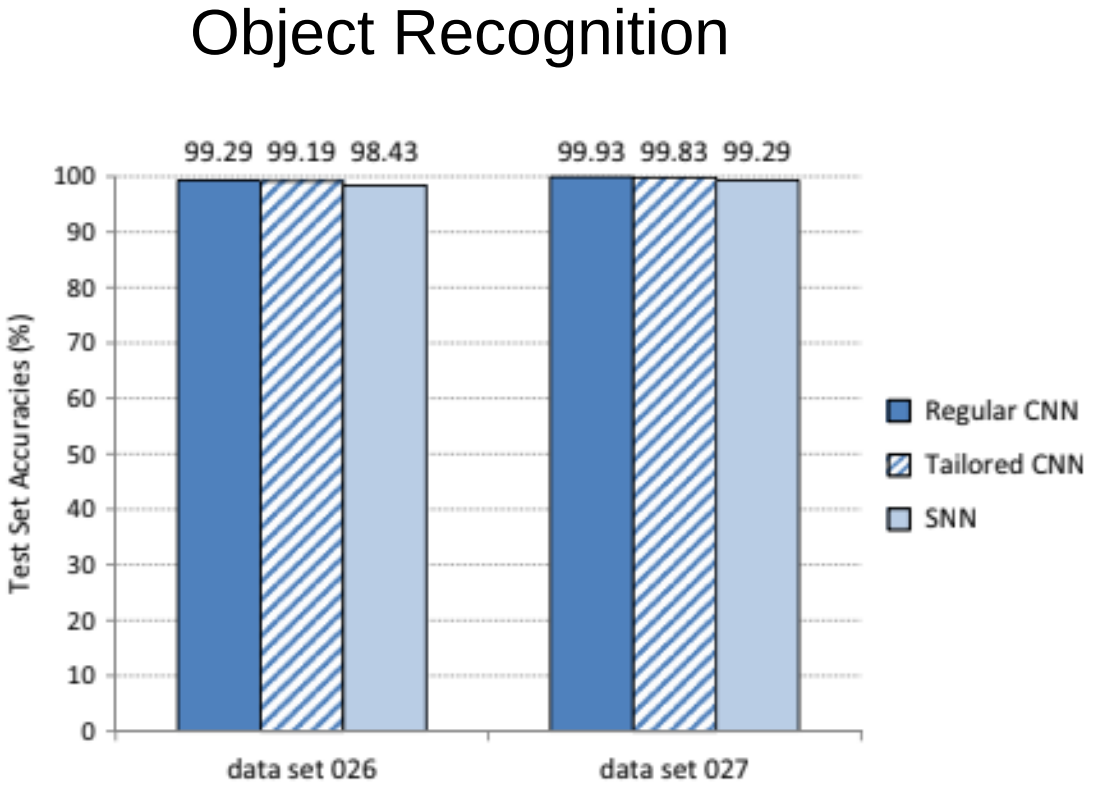
- Pfeiffer and Pfiel. 2018.

  “Deep Learning With Spiking Neurons: Opportunities and Challenges”

  Build your own SNNs with:

  Bindsnet (Python package built on PyTorch)

Accuracy Comparable to Conventional CNN



Object recognition in Neovision2 Tower Dataset. Cao et al., 2014. Spiking Deep Convolutional Neural Networks for Energy Efficient Object Recognition

How to train your dragon

- Local training rules
  - Hebbian (fire together, wire together)
  - STDP (relative firing time is important)
- Supervised rules
  - Reward modulated STDP