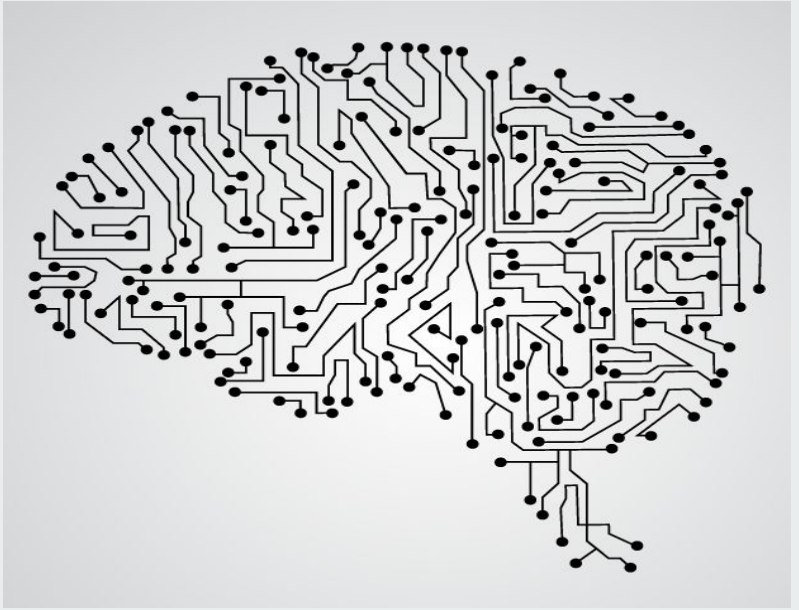
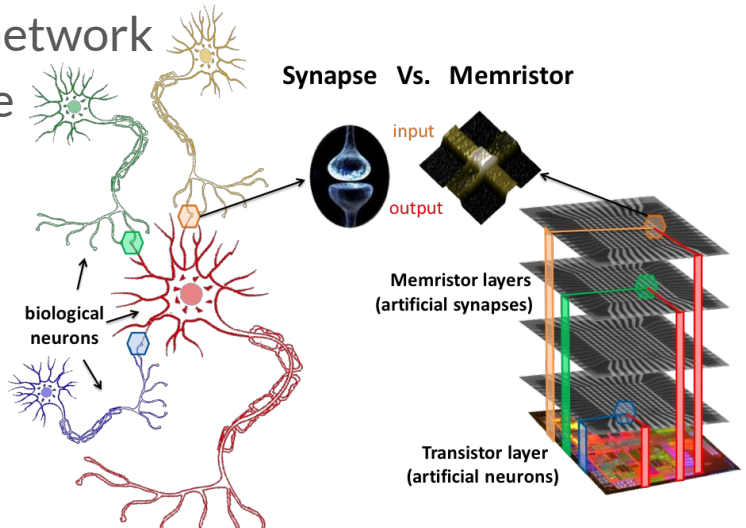
Neuromorphic Computing

Jacob Haynes



What is Neuromorphic Computing?

- Hardware architecture modeled after the human brain
- Comprised of a network of **neurons** and **synapses**
- Neurons pulse electric signals as input
- Output based on path taken through the network
- Highly connected and parallel architecture
  - Side-by-side memory and processing
- Low power usage



History

- The term “Neuromorphic Computing” was introduced in 1990 by Carver Mead
- Emerged to compete with traditional computer architectures
- Potential for faster complex computations while remaining power efficient
- Machine learning is becoming very popular
    - Neuromorphic computing may be the best platform for ML algorithms moving forward

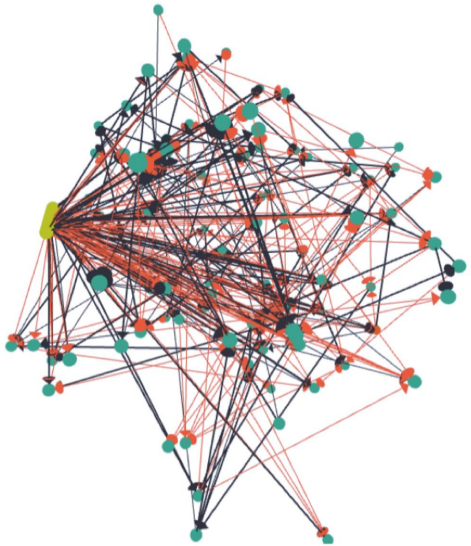
Specifics

- Neuron
  - A function that operates on an input
- Synapse
  - Processes neuron output and passes a state to another neuron
  - Can be trained to know how to convert neuron output to states
- Memristor
  - Component that remembers the charge of an electric current

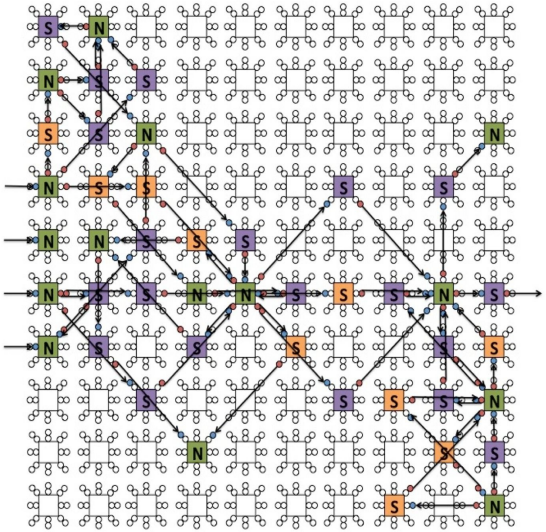
Memristors are great for neuromorphic computing as they provide neuroplasticity

Existing Neuromorphic Computing Models

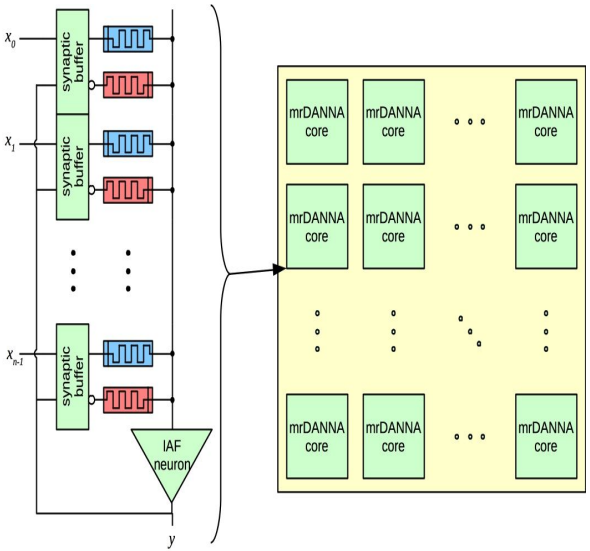
NIDA



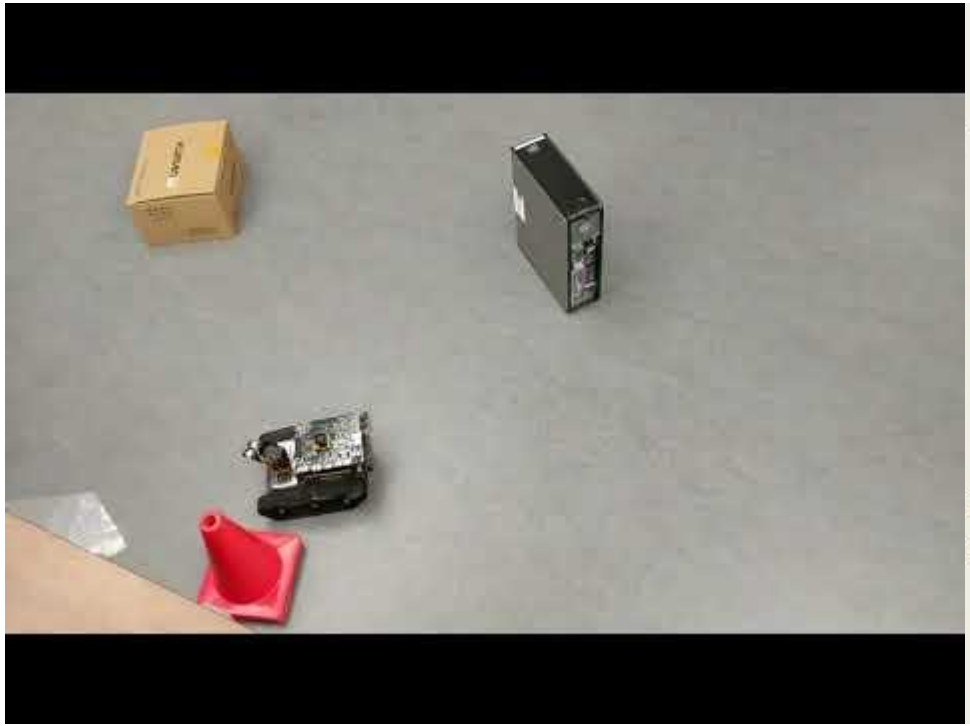
DANNA

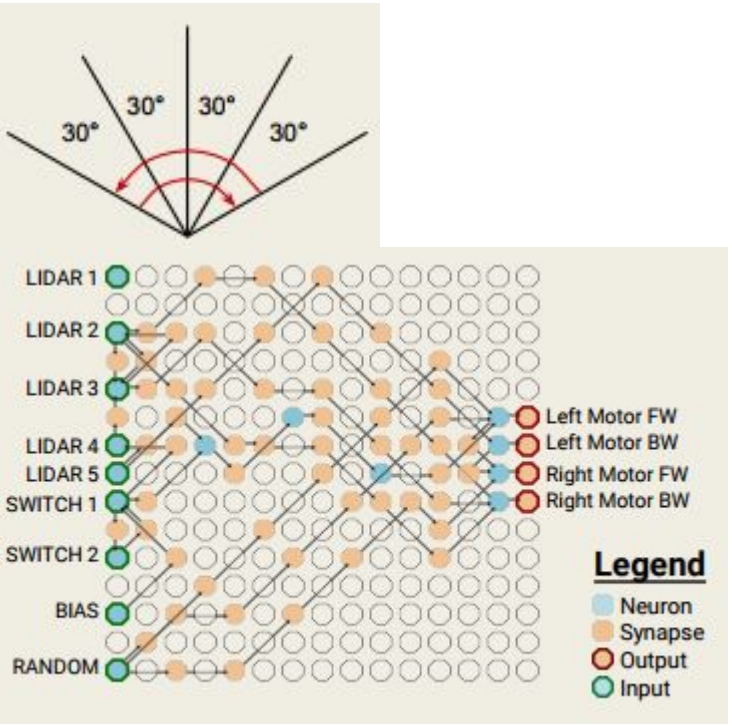


mrDANNA



Application





Thanks for watching!

Sources are included in the description.

Works Cited

- A Survey of Neuromorphic Computing and Neural Networks in Hardware
  - https://arxiv.org/pdf/1705.06963.pdf
- NIDA, DANNA, mrDANNA
  - http://neuromorphic.eecs.utk.edu/pages/research-overview/
- Neuromorphic Navigation with DANNA
  - Video
    - http://neuromorphic.eecs.utk.edu/demos/2017-robonav-fpga
  - Poster
    - http://neuromorphic.eecs.utk.edu/raw/files/posters/2017-NCS-MitchellBruer.pdf