

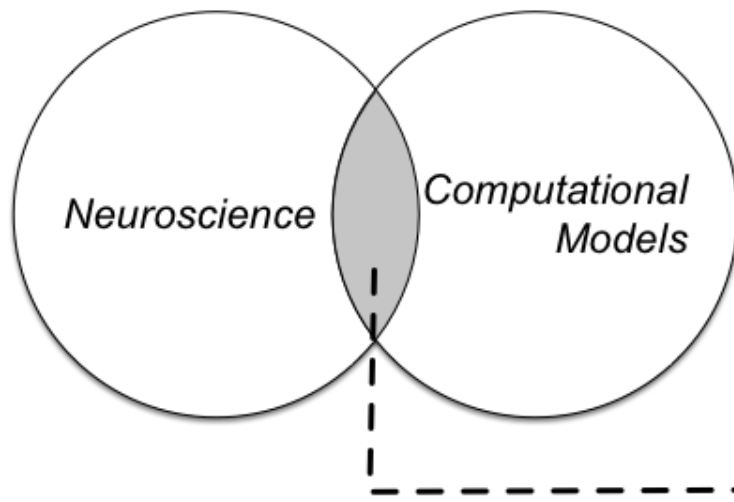


- Organization: Numenta, Inc.
- Lead investigator: Jeff Hawkins
- Team members:
 - Subutai Ahmad
 - Scott Purdy
 - Chetan Surpur



Numenta has two broad research goals:

1. Understand the computational principles of the cortex
2. Implement intelligent systems that operate on those principles



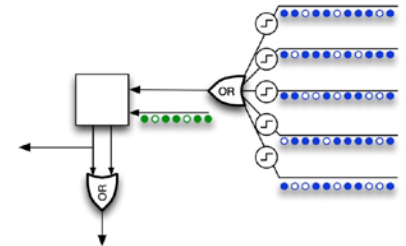
Our research approach:

1. Fidelity to biological principles
2. Computational implementation
3. Release as open source and commercial products



Numenta

- Created and published a computational theory of the neocortex called Hierarchical Temporal Memory (HTM)
- HTM theory implemented and validated in applications
 - Streaming anomaly detection for cloud deployments and datacenters
 - Real time geospatial anomaly detection
 - Internal intrusion detection
- HTM codebase released as the open source project NuPIC
 - 1000 people on 3 mailing lists, 48 contributors around the world
 - Highlighted by github as a top machine learning project
- Recent progress on theory of canonical microcircuit within cortical layers and minicolumns
 - Theory demonstrates how laminar circuits implement sequence memory, feedback, sensorimotor control, hierarchy, invariance, learning and attention





Research Proposal: Learning Invariances

- Background: Neurons in V4 and IT have been shown to represent highly invariant but specific visual categories. A holy grail for cortical models is to show how arbitrary invariances can be learned (i.e. without hardcoding) for diverse sensory modalities. This capability is key to robust pattern recognition and hierarchies.
- Proposal: We are developing a theory that explains exactly how the cortex learns invariances. We wish to lead a team to expand the scope of this work, and demonstrate robust learning of invariances for a sensory modality. The goal is to implement a cortical model that learns invariant representations for a large number of categories.
- We are searching for team members that have:
 - deep expertise and data collection in a sensory area such as vision, audition, 3D sensors
 - significant hardware and software resources for running large experiments
 - the ability to design and conduct neuroscience experiments to test the theory



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