Neurithmic Systems LLC

Organization: Neurithmic Systems LLC
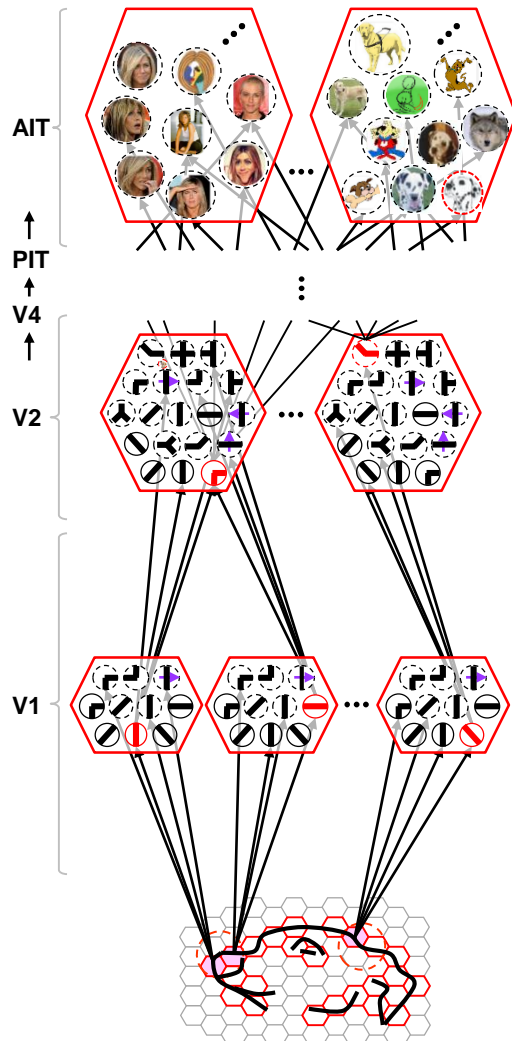
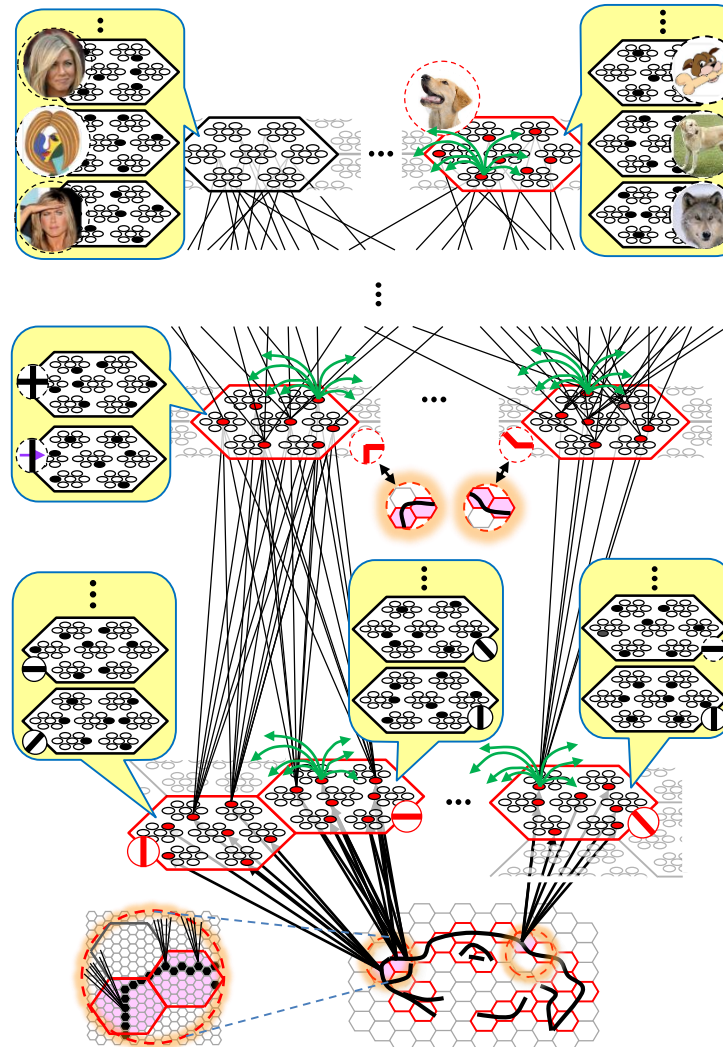**Lead Investigator:** Gerard (Rod) Rinkus

Current Team Members: - Neurithmic Systems LLC

- …

- MICrONS: Revolutionize machine intelligence by emulating the brain's computing "primitives" and the large-scale architecture in which they are embedded.

- Neurithmic Systems is developing a canonical cortical circuit model (TEMECOR, Sparsey®) and seeks to build a MICrONS Program based on it.

- Sparsey is a generic spatiotemporal probabilistic learning / inference algorithm

- Currently being applied to video and multi-modal event recognition under ONR and DARPA UPSIDE support

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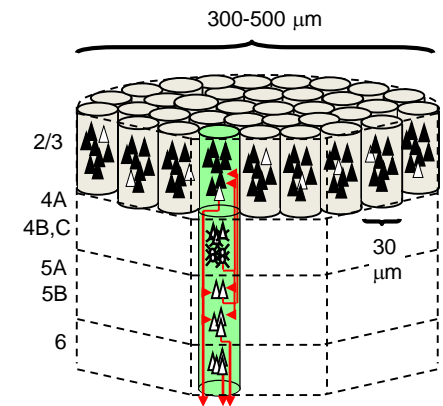- Core or "primitive" module is proposed analog of the cortical macrocolumn

- E.g., cortical patch of ~300-600 um diameter, that acts as an essentially autonomous module that…

- Learns (stores) and subsequently can recognize spatiotemporal patterns of neural activation in its total input (bottom-up, horizontal, top-down)

- In vivo, "macrocolumns" may physically overlap

a) Localist

b) Sparse Distributed

Unique Qualifications and Capabilities

- Sparsey's most critical property is that it uses *sparse distributed codes* (SDCs), rather than *localist* codes, to represent all (spatial or spatiotemporal) items of information at all levels of the hierarchy

- This confers fixed-time storage (learning) and fixed-time best-match retrieval (recognition, inference, recall, prediction) for life of system. No other published information-processing algorithm of any kind has this capability !

- Other key properties:

  - Deals natively with spatiotemporal inputs and in fact, multi-modal spatiotemporal inputs.

  - Learns all features from scratch (assumes only the "smoothness prior")

  - Learning is single-trial; core model goal is to simultaneously explain episodic and semantic memory, where semantic memory automatically emerges as the pattern of intersections over the stored SDCs of episodic memories.

  - Combines unsupervised and supervised learning.

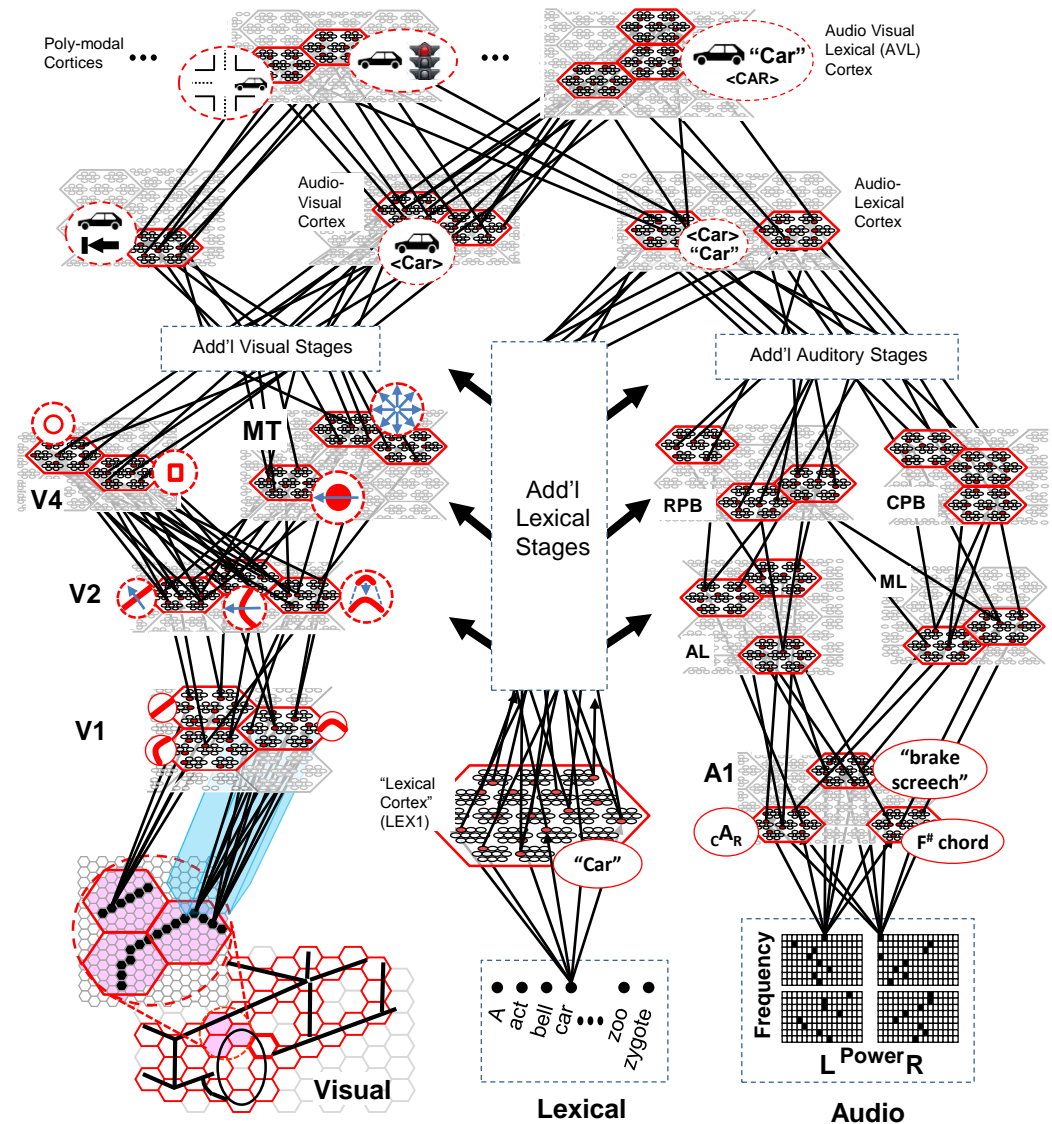 - Competes with graphical probability models, deep learning models

- Looking to work with experimentalists and modelers interested in…

Biological Vetting

- Find evidence for SDCs in cortex (2-photon calcium, etc.) and analyze
- Explicitly model L2/3, L4, L5, L6 populations
- Elaborate/Test analogy between model functions and major neuromod. systems, ACh, NE,..
- Develop / integrate hippocampus analog to model
- Integrate thalamus details and recurrent pathways involving thal.
- Integrate basal ganglia, motor cortices

Applications

- Continue working on event recognition in video
- Continue work on multi-modal, e.g., audio/visual, learning & recognition
- Olfactory processing
- Motor/robotics

Contact Information

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