

Gerard J. Rinkus 468 Waltham Street, Newton, MA 02465 (c) 617-997-6272
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Education

- 2004-2006 Postdoc, Computational neuroscience, with John Lisman. Brandeis University. Jointly supported by NIH and The Redwood Neuroscience Institute.
- 1996 Ph.D., Cognitive & Neural Systems. Boston University, Boston, Mass.
 Advisor: Daniel H. Bullock, Associate Professor, Cognitive & Neural Systems
 Thesis: A Combinatorial Neural Network Exhibiting Episodic and Semantic Memory Properties for Spatio-Temporal Patterns.
- 1989-1990 Ph.D. Student (Teaching Asst.), Exper. Psych. Dept., NYU, New York, N.Y.
- 1986 M.A., Computer Science. Hofstra University, Hempstead, N.Y.
- 1983 B.A., Cognitive Science. University of Rochester, Rochester, N.Y.

Programming Experience

Current: Java, ImageJ, Git, HTML, CSS, Dreamweaver, Python

Past: C++, multithreading, Web apps (applet, servlet, JSP, MySQL, JDBC, Javascript), Java3D, Perl, Tcl, Tk, LabView, Excel Macros, OPS5, Pascal, Assembler, Lisp

Employment History

Jan 2010 - Present President & Chief Scientist, [Neurithmic Systems](#), Newton, MA

R&D on biologically-inspired, probabilistic, hierarchical associative memory for unsupervised learning, recognition, recall of spatiotemporal patterns, e.g., video, speech, biosequences.

Funded by research contracts: DARPA MTO UPSIDE Seedling (FA8650-13-C-7432); Northrop Grumman (Sub on Cortical Processing Seedling); ONR 341 (Tom McKenna) (N00014-12-C-0539); DARPA Deep Learning: Sub#337178J on N00173-09-C-2038.

Jan 2007 - Jul 2009 Senior Research Engineer, Scientific Systems Co Inc., Woburn, MA

Conceptual design for heterogeneous database alignment including geospatial reasoning. Proposal writing, Presentation preparation (Powerpoint, animation).

Sep 2004 - Dec 2006 Computational Neuroscience Postdoc / Visiting Scientist, Brandeis University, Mentor: John Lisman, Waltham, MA

Developed neuromorphic, hierarchical models of sequence learning and recognition (Java).

Developed cell-assembly-based, canonical cortical microcircuit model.

Developed GUI/visualization software in Swing/Java3D-based.

Jun 1999 - Oct 2003 Research Programmer, Enkidu Research. Lockport, NY

Developed apps for R&D and commercial augmentative communication devices including

- Web-based (Applet, Servlet, JSP, Javascript, JDBC, Tomcat, MySql) teaching application concerning the design/use of augmentative communications devices.
- Multithreaded webcrawler (C/MFC) that scraped web page text to generate language statistics.
- Windows/MFC-based application for statistical analysis of log files.

Jun 1996 - Jun 1999 Senior Scientist, Charles River Analytics. Cambridge, MA

Managed/executed DoD/Nasa Phase I/II SBIRs developing Bayes nets, case-based reasoning, and other AI technologies for situation/threat assessment, cognitive state estimation, battlefield course-of-action estimation and planning.

Oct 1995 - Mar 1996 Programmer, Mercury Computer Systems, Inc. Chelmsford, MA

Developed and ran QA test suite of input/output and interprocess communication APIs for Mercury's multi-computer operating system, using Perl and Perl/Tcl/Tk.

Sep 1992 - Sep 1995 Research Programmer Army Research Lab, Watertown, MA

Developed data acquisition modules (GPIB/LabView), neural-net-based process control and analysis of tank shock absorber data.

Sep 1990 - Aug 1991 Asst. System Admin. Cognitive & Neural Systems, Boston University

Performed Sysadmin duties for CNS Dept, while enrolled as full-time PhD student.

Sep 1989 - Aug 1990 Graduate Teaching Asst., Experimental Psychology, NYU, NY

Organized and ran recitation sections, assisted with grading for Fundamentals in Neuroanatomy.

Sep 1986 - Aug 1988 Instructor, Math & Comp. Sci., Adelphi University, Garden City, NY

Full responsibility for developing all curricula/materials, teaching, grading, and advising undergraduates for three classes, Introduction to Computer Science, Data Structures, and Computer Architecture and Assembly Language, each taught multiple times.

Jul 1984 - Apr 1986 Software Engineer, Hazeltine Inc. Greenlawn, NY

Developed Expert System (in OPS5) for controlling the manufacture of printed circuit boards.

Patents

1. [Overcoding-and-Paring: A bufferless chunking process and uses thereof](#) US Pat. 8,983,884
2. Methods and apparatus for sequence recognition using sparse distributed codes (pending)

Journal Papers & Recently Submitted

Rinkus, G. ([submitted abstract](#)): Cell assemblies encode full likelihood distributions and communicate via atemporal first-spike codes. COSYNE 2019.

Rinkus, G. ([accepted abstract](#)): NIPS Continual Learning Wkshp 2018. Sparsey, a memory-centric model of on-line, fixed-time, unsupervised continual learning. Montreal 2018

Rinkus, G. ([accepted abstract \(poster\)](#), withdrawn because cannot attend): First Spike Combinatorial Coding: The Key to Brain's Computational Efficiency. Cognitive Computing 2018.

Rinkus, G. & Leveille, J. (2017, [arXiv](#), submitted) Superposed Episodic and Semantic Memory via Sparse Distributed Representations.

Rinkus, G. (2017, [arXiv](#), submitted) A Radically New Theory of how the Brain Represents and Computes with Probabilities.

[Rinkus, G. \(2014\)](#) Sparsey: Event recognition via deep hierarchical sparse distributed codes. *Frontiers in Neuroanatomy*. doi: 10.3389/fncom.2014.00160

[Rinkus, G. \(2012\)](#) Quantum Computation via Sparse Distributed Representation. *NeuroQuantology* **10**(2) 311-315.

[Rinkus, G. \(2010\)](#) A cortical sparse distributed coding model linking mini- and macrocolumn-scale functionality. *Frontiers in Neuroanatomy* 4:17. doi:10.3389/fnana.2010.00017

Sincebaugh, P., Green, W. & Rinkus, G. (1996) A Neural Network Based Diagnostic Test System for Armored Vehicle Shock Absorbers. *Expert Systems with Applications*, **11**(2) 237-244.

Invited Talks

- 07/23/18: Sparse distributed representation, hierarchy, critical periods, metaplasticity: the keys to lifelong fixed-time learning and best-match retrieval. ([abstract](#)) Biological Distributed Algorithms 2018 (London)
- 12/18/17: A Radically Novel Theory of Probabilistic Computing in the Brain. To Xaq Pitkow Lab
- 04/21/17: Sparse Distributed Coding Enables Super-Efficient Probabilistic Modeling. Intel Microarchitecture Technology Lab. Hillsboro, OR Host: Narayan Srinavasa
- 04/20/17: Sparse Distributed Coding Enables Super-Efficient Probabilistic Modeling. IBM Almaden Machine Intelligence Lab, San Jose, CA. Host: Winfried Wilcke
- 09/02/16: Sparsey[®]: Scalable Machine Intelligence via Hierarchical Sparse Distributed Representations. GE Global Research, Niskayuna, NY. Host: Joe Salvo
- 03/07/16: Sparse Distributed Representation Trumps Machine Parallelism for Improving Computational Efficiency. Neuro-Inspired Computational Elements (NICE 2016), Berkeley, CA
- 03/11/14: Sparse Distributed Coding & Hierarchy: The Keys to Scalable Machine Intelligence. DARPA UPSIDE Year 1 Review Presentation.
- 06/26/13: A Cortical Macrocolumn Model based on Sparse Distributed Representation. Large-Scale Applications Using Cortical Processing Models Wkshp, DARPA, Arlington, VA.
- 02/25/13: Constant-Time Probabilistic Learning & Inference via Hierarchical Sparse Distributed Representations. Neuro-Inspired Computational Elements (NICE) Workshop, Sandia Labs, Albuquerque. Feb 25-27. Host: Murat Okandan.
- 12/14/12: Probabilistic Computing via Sparse Distributed Representations. Lyric Semiconductor Theory Seminar. Host: Ben Vigoda.
- 08/31/09: Overcoding-and-Pruning: A Novel Neural Model of Temporal Chunking and Short-term Memory. Kreiman Lab, Dept. of Ophthalmology and Neuroscience, Children's Hospital, Boston. Host: Gabriel Kreiman.
- 10/07: A Functional Role for the Minicolumn in Cortical Population Coding. Cortical Modularity and Autism Symposium. The U. of Louisville, Health Sciences Center. Host: Manuel Casanova.
- 02/06: Hierarchical Sparse Distributed Representations of Sequence Recall and Recognition. The Redwood Center for Theoretical Neuroscience. (UC Berkeley). Host: Bruno Olshausen.
- 06/04: A Sparse Distributed Model of Episodic and Semantic Spatiotemporal Memory. Redwood Neuroscience Institute, Menlo Park, CA. Host: Fritz Sommer.

Selected Conference Papers, Posters,

- Rinkus (2017) A Radically New Theory of How the Brain Represents and Computes with Probabilities. (Poster) Neuro-Inspired Comp. Elements (NICE 2017), IBM Almaden, San Jose
- Rinkus, G. (2014) Cortex-inspired technology yields scalable probabilistic inference over events. (Poster) IARPA Machine Intelligence from Cortical Networks (MICrONS) Wkshp: 2/11/14
- Rinkus, G. (2013) A cortical theory of super-efficient probabilistic inference based on sparse distributed representations. 22nd Annual CNS Meeting, Paris, July 13-18. *BMC Neuroscience* 2013, **14**(Suppl 1): P324
- Rinkus, G. (2009) Overcoding-and-pruning: a bufferless neural chunking model. *Frontiers in Computational Neuroscience*. COSYNE '09 Abstract: doi: 10.3389/conf.neuro.10.2009.03.292
- Rinkus, G. (2008) Population Coding Using Familiarity-Contingent Noise. *AREADNE 2008: Research in Encoding and Decoding of Neural Ensembles*, Santorini, Greece, June 26-29
- Rinkus, G. & Lisman, J. (2005) Time-Invariant Recognition of Spatiotemporal Patterns in a Hierarchical Cortical Model with a Caudal-Rostral Persistence Gradient. *Society for Neuroscience Annual Meeting, 2005*. Washington, DC. Nov 12-16

- Rinkus, G. (2005) A Neural Network Model of Time-Invariant Spatiotemporal Pattern Recognition *First Annual Computational Cognitive Neuroscience Conference*, Washington, DC, Nov. 10-11
- Rinkus, G. (2004) A Neural Model of Episodic and Semantic Spatiotemporal Memory. *Proc. of the 26th Annual Conference of the Cognitive Science Society*. Kenneth Forbus, Dedre Gentner & Terry Regier, Eds. LEA, NJ. 1155-1160. Chicago, Ill.
- Leshner, G.W., Moulton, B.J., Rinkus, G. & Higginbotham, D.J. (2003) Software tools for emulation and analysis of augmented communication. *CSUN 2003*, California State University, Northridge.
- Leshner, G.W. & Rinkus, G. (2002) Leveraging word prediction to improve character prediction in a scanning configuration. *Proc. of the RESNA 2002 Annual Conference*, Reno.
- Leshner, G.W. & Rinkus, G. (2001) Domain-specific word prediction for augmentative communications. *Proc. of the RESNA 2002 Annual Conference*, Reno.
- Leshner, G.W. & Rinkus, G. (2001) Domain-specific word prediction for augmentative communications. *Proc. of the RESNA 2002 Annual Conference*, Reno.
- Leshner, G.W., Rinkus, G., Moulton, B.J., & Higginbotham, D.J. (2000) Logging and analysis of augmentative communication. *Proc. of the RESNA 2000 Annual Conference*, Reno. 82-85.
- Gonsalves, P.G. & Rinkus, G. (1998) Intelligent fusion and asset manager processor (IFAMP). *Proc. of the IEEE Information Technology Conference* (Syracuse, NY) 15-18.
- Rinkus, G. (1997) A Monolithic Distributed Representation Supporting Multi-Scale Spatio-Temporal Pattern Recognition. *International Conference on Vision, Recognition, and Action: Neural Models of Mind and Machine*, Boston University, Boston, Mass. May 29-31.
- Rinkus, G. (1995) TEMECOR: An Associative, Spatio-Temporal Pattern Memory for Complex State Sequences. *Proc. of 1995 World Congress on Neural Networks*, v. I, 442-448, Wash., DC
- Rinkus, G. (1993) Context-sensitive Spatio-temporal Pattern Memory. (1993) *Proc. of the 1993 World Congress on Neural Networks*, v. II, 344-347, Portland, OR.
- Rinkus, G. (1992) A Neural Model for Spatio-temporal Pattern Memory. *Proc. Wang Conference: Neural Networks for Learning, Recognition, and Control*, Boston University, Boston, Mass
- Rinkus, G. (1988) Learning as Natural Selection in a Sensori-Motor Being. *Proc. 1st Annual Conference of the Neural Network Society*, Boston, Mass.
- Mulgund, S., Rinkus, G., Illgen, C. & Zacharias, G. (1997) Situation Awareness Modeling and Pilot State Estimation for Tactical Cockpit Interfaces. *HCI International*, San Francisco, CA, August.
- Mulgund, S.S., Illgen, C., Rinkus, G., Zacharias, G.L. & Friske, J. (1997) OLIPSA: On-Line Intelligent Processor for Situation Assessment. *Proc. of 2nd Ann. Symp. on Situational Awareness in the Tactical Air Environment*. NAWCAD, Patuxent River, Md. June 3-4.

Book Chapters

- Mulgund, S.S., Zacharias, G.L. & Rinkus, G. (2003) Adaptive Pilot-Vehicle Interfaces for the Tactical Air Environment. in *Psychological Issues in the Design and Use of Virtual Adaptive Environments*. Hettinger, L.J. & Haas, M. (Eds.) LEA, NJ 483-524.

Theses

- Rinkus, G. (1996) A Combinatorial Neural Network Exhibiting Episodic and Semantic Memory Properties for Spatio-Temporal Patterns. Ph.D. Thesis. Boston University, Boston, Mass.
- Rinkus, G. (1986) Learning as Natural Selection in a Sensori-Motor Being. Master's Thesis. Hofstra University, Hempstead, N.Y.

Professional Activities

- Program Committee: 1st International Workshop on Computational Models of the Visual Cortex, to be held Dec 2-5, NYC.

Program Committee: [Workshop on Unsupervised & Transfer Learning](#): ICML 2011, Bellevue, WA
Organization for Computational Neurosciences, Faculty Member, 2012-2014.

Presenter & Panel Discussant. IARPA Automatic Machine Learning Workshop (4/16-17, 2012),
NSF, Arlington, VA.

Funding

- Northrop Grumman: Awarded in response to NG RFQ 6000675674 (follow-on to Cortical Processing Algorithm) 7/15-1/16
- Northrop Grumman: Con# 8200176119 IRAD Cortical Processing Algorithm 1/21/14-4/21/14
- DARPA MTO (UPSIDE Program): FA8650-13-C-7432: Sparse Distributed Representation and Hierarchy: The Keys to Scalable Machine Intelligence: 4/29/13-12/30/15
- ONR 341: N00014-12-C-0539: Scalable Machine Vision via Hierarchical Sparse Distributed Representations: 8/15/2012-2/15/2014
- DARPA Deep Learning Program: Sub#337178J on Con#N00173-09-C-2038: 03/2010–05/2011
- NIH Postdoc Training Grant 5 T32 NS07292 (Brandeis) 9/2004-4/2006