CURRICULUM VITAE

January 17, 2020

1. NAME, POSITION, ACADEMIC DEPARTMENTS

Élie Lucien Bienenstock
Associate Professor
Division of Applied Mathematics and Department of Neuroscience, Brown
University

2. HOME ADDRESS

295 Olney Street, Providence RI 02906, USA

3. EDUCATION
   a. 1980: Ph.D., Applied Mathematics, Brown University, Thesis Advisor:
      Prof. L.N. Cooper, Dissertation Topic: *A Theory for the Development of
      Neuronal Selectivity*.
   b. 1977: M.Sc., Telecommunications Engineering, École Nationale
      Supérieure des Télécommunications (ENST), Paris.
   c. 1975: M.Sc., Mathematics, Hebrew University, Jerusalem.
   d. 1973: B.Sc., Mathematics and Physics, Hebrew University, Jerusalem.

4. EMPLOYMENT

   a. July 2000-present: Associate Professor, Division of Applied Mathematics
      and Department of Neuroscience, Brown University.
   b. 1991-June 2000: Visiting Professor (Research), Division of Applied
      Mathematics, Brown University.
   c. 1980-June 2000: Tenured Research Scientist, Centre National de la
      Recherche Scientifique (CNRS), Paris. On leave from CNRS since 1991.

5. COMPLETED PUBLICATIONS

a. **BOOK EDITED** *Disordered Systems and Biological Organization.* Book edited with Françoise Fogelman-Soulié and Gérard Weisbuch, Proceedings of a NATO Workshop at Les Houches, France, March 1985, Springer-Verlag, Berlin (1986).

b. **BOOK CHAPTERS**

Specific Functional Modifications of Individual Cortical Neurons triggered by Vision and Passive Eye Movement in Immobilized Kittens, with Yves Frégnac, In: *Doc. Ophthal. Proc. Series*, L. Maffei, ed. W. Junk Publishers, The Hague, 30, 100-108 (1981).

Cooperation and Competition in Central Nervous System Development: A Unifying Approach, in: *Synergetics of the Brain*, E. Basar, H. Flohr, H. Haken, and A.J. Mandell, eds., Springer-Verlag, Berlin, pp. 250-263 (1983).

Une approche topologique de l'objet mental, in: *Les théories de la complexité,* F. Fogelman-Soulié, ed., Le Seuil, Paris, pp. 238-255 (1991).

Dynamics of the Central Nervous System, in: *Dynamics of Macrosystems*, J.P. Aubin, D. Saari, and K. Sigmund, eds., Springer-Verlag, Berlin, pp. 3-20 (1985).

Statistical Coding and Short-Term Synaptic Plasticity: A Scheme for Knowledge Representation in the Brain, with Christoph von der Malsburg, in: *Disordered Systems and Biological Organization*, E. Bienenstock, F. Fogelman and G. Weisbuch eds., pp. 247-272, Springer-Verlag, Berlin (1986).

Neural-Like Graph-Matching Techniques for Image Processing, in: *Organization of Neural Networks*, W. von Seelen, G. Shaw, and U.M. Leinhos eds., pp. 211-235, VCH Verlagsgesellschaft, Weinheim, Germany (1988).

Relational Models In Natural and Artificial Vision, in: *Neural Computers*, R. Eckmiller and Ch. von der Malsburg eds., pp. 61-70, Springer-Verlag, Berlin (1988).

Elastic Matching and Pattern Recognition in Neural Networks, with René Doursat, in: *Neural Networks: From Models to Applications*, L. Personnaz and G. Dreyfus eds., pp. 472-482, IDSET, Paris, (1989).

Hebbian Synapses and Visual Cortical Plasticity, with Yves Frégnac and Daniel Shulz, Proceedings of AFCET International Conference on Neural Networks, Lyon, (1990).

Spatio-Temporal Coding and the Compositionality of Cognition, with René Doursat, Proceedings of Workshop on *Temporal Correlations and Temporal Coding in the Brain*, R. Lestienne, ed., pp. 42-47, Paris, April 25-27, 1990.

Issues of Representation in Neural Networks, with René Doursat in: *Representations of Vision: Trends and Tacit Assumptions in Vision Research*, A. Gorea, ed., pp. 47-67, Cambridge University Press (1991).

Vision naturelle et vision artificielle, in: *Les réseaux de neurones*-Rapport de l'Observatoire Francais des Techniques Avancées, pp. 93-117, Masson, Paris (1991).

Visual pattern processing using a neural-network based approach, in: *Les Sciences Cognitives en Débat*, Éditions du CNRS, Paris, Gérard Vergnaud ed., pp. 301-315 (1991)

Notes on the Growth of a Composition Machine, in: Proceedings of First Interdisciplinary Workshop on *Compositionality in Cognition and Neural Networks*, Abbaye de Royaumont, France, May 27-28, 1991, D. Andler, E. Bienenstock and B. Laks eds., pp. 25-43.

Suggestions for a Neurobiological Approach to Syntax, in: Proceedings of Second Interdisciplinary Workshop on *Compositionality in Cognition and Neural Networks*, Abbaye de Royaumont, France, June 29-30, 1992, D. Andler, E. Bienenstock and B. Laks eds., pp. 13-21.

Elie Bienenstock and Stuart Geman (1995) Compositionality in Neural Systems, in *The Handbook of Brain Theory and Neural Networks,* M.A. Arbib ed., M.I.T./Bradford Press, pp. 223-226.

Elie Bienenstock (1996) Composition, In *Brain Theory: Biological Basis and Computational Principles,* A. Aertsen and V. Braitenberg eds., Elsevier, pp 269-300.

Elie Bienenstock, Stuart Geman and Daniel Potter (1997) Compositionality, MDL Priors, and Object Recognition, with, In: *Advances in Neural Information Processing Systems 9*, M.C. Mozer, M.I. Jordan, and T. Petsche, eds., MIT Press, 838-844.

Correlational Models of Synaptic Plasticity: Development, Learning and Cortical Dynamics of Mental Representations, with Yves Frégnac, In: *Mechanistic Relationships between Development and Learning*, T. Carew, R. Menzel and C. Shatz eds., Wiley and sons, pp 113-148 (1998).

Wu, W., Black, M. J., Gao, Y., Bienenstock, E., Serruya, M., and Donoghue, J. P. (2002) Inferring hand motion from multi-cell recordings in motor cortex using a Kalman filter. In: *SAB'02-Workshop on Motor Control in Humans and Robots: On the Interplay of Real Brains and Artificial Devices,* August 10, 2002, Edinburgh, Scotland (UK), pp. 66-73. (pdf)

Yun Gao, Michael J. Black, Elie Bienenstock, Shy Shoham and John P. Donoghue (2002) Probabilistic Inference of Arm Motion from Neural Activity in Motor Cortex, *Advances in Neural Information Processing Systems 14*, Thomas G. Dietterich, Sue Becker, and Zoubin Ghahramani, eds., MIT Press, 213-220. (pdf)

Wei Wu, Michael J. Black, Yun Gao, Elie Bienenstock, Michael Serruya, Amar Shaikouni, and John P. Donoghue (2003) Neural Decoding of Cursor Motion using a Kalman Filter, *Advances in Neural Information Processing Systems 15*, Suzanna Becker, Sebastian Thrun, and Klaus Obermayer, eds., MIT Press, pp. 133-140. (pdf)

c. ARTICLES IN REFEREED JOURNALS AND REFEREED CONFERENCE PROCEEDINGS

Elie Bienenstock (1977) Sets of Degrees of Computable Fields, *Israel Journal of Mathematics*, 27, 348-356.

Yves Frégnac, Yves Trotter, Elie Bienenstock, Pierre Buisseret, Elyane Gary-Bobo, and Michel Imbert (1981) Effect of Neonatal Unilateral Enucleation on the Development of Orientation Selectivity in the Primary Visual Cortex of Normally and Dark-reared Kittens, *Experimental Brain Research*, 42, 453-466.

Elie Bienenstock, Leon N. Cooper, and P. Munro (1982) A Theory for the Development of Neuron Selectivity: Orientation Specificity and Binocular Interaction in Visual Cortex, *The Journal of Neuroscience*, 2, 32-48.

Elie Bienenstock, Yves Frégnac, and Simon Thorpe (1983) Ionophoretic Clamp of Activity in Visual Cortical Neurons in the Cat: A Test of Hebb's Hypothesis, Proceedings of the Physiological Society, 21-23 July 1983, *Journal of Physiology* (London), 345, p. 123P.

Christoph von der Malsburg and Elie Bienenstock (1987) A Neural Network for the Retrieval of Superimposed Connection Patterns, *Europhysics Letters*, 3 (11), 1243-1249.

Elie Bienenstock and Christoph von der Malsburg (1987) A Neural Network for Invariant Pattern Recognition, *Europhysics Letters*, 4 (1), 121-126.

Yves Frégnac, Dan Shulz, and Simon Thorpe and Elie Bienenstock (1988) A Cellular Analogue of Visual Cortical Plasticity, *Nature*, 333, No. 6170, 367-370.

Yves Frégnac, Daniel Shulz, and Simon Thorpe and Elie Bienenstock (1992) Cellular Analogs of Visual Cortical Epigenesis: 1. Plasticity of Orientation Selectivity, *The Journal of Neuroscience*, 12 (4), 1280-1300.

Stuart Geman, Elie Bienenstock and René Doursat (1992) Neural Networks and the Bias/Variance Dilemma, *Neural Computation*, 4, 1-58.

Elie Bienenstock and René Doursat (1994) A Shape-Recognition Model Using Dynamical Links, *Network: Computation in Neural Systems,* 5 241-258.

Elie Bienenstock (1995) A Model of Neocortex, *Network: Computation in Neural Systems,* 6 179-224.

Elie Bienenstock (1996) On the Dimensionality of Cortical Graphs, *Journal of Physiology*, Paris, 90 251-256.

Elie Bienenstock and Daniel Lehmann (1998) Regulated Criticality in the Brain? *Adv. Complex Systems*, 1, 361-384.

Akira Date, Elie Bienenstock and Stuart Geman (1999) A statistical technique for the detection of fine temporal structure in multi-neuronal spike trains," *Soc. Neurosci. Abstr.*, 25, part 2, p.1411.

Akira Date, Elie Bienenstock and Stuart Geman (2000) A Statistical Tool for Testing Hypothesis about the Temporal Resolution of Neural Activity, *Soc. Neurosci. Abstr.*, 26: 828.6.

Nicholas G. Hatsopoulos, Asohan Amarasingham, Elie Bienenstock, Stuart Geman and John P. Donoghue (2001) Assessing Precise Temporal Patterns of Spikes among Cortical Neurons, *Soc. Neurosci. Abstr.*, 27: 63.1.

Yun Gao, Elie Bienenstock, Michael J. Black, Shy Shoham, Mijail Serruya and John P. Donoghue (2001) Encoding/Decoding of Arm Kinematics from Simultaneously Recorded MI Neurons, *Soc. Neurosci. Abstr.*, 27: 63.3.

W. Wu, M. Black, Y. Gao, E. Bienenstock, M. Serruya, J. Donoghue. INFERRING HAND MOTION FROM MULTI-CELL RECORDINGS IN MOTOR CORTEX USING A KALMAN FILTER Program No. 357.5. Washington, DC: *Soc. Neurosci. Abstr.*, 2002.

Wu, W., Black, M. J., Mumford, D., Gao, Y., Bienenstock, E., Donoghue, J. P., A switching Kalman filter model for the motor cortical coding of hand motion, *Proc. IEEE Engineering in Medicine and Biology Society*, pp. 2083-2086 (2003). (pdf)

Black, M. J., Bienenstock, E., Donoghue, J. P., Serruya, M., Wu, W., Gao, Y. (2003) Connecting brains with machines: The neural control of 2D cursor movement, *1st International IEEE/EMBS Conference on Neural Engineering,* pp. 580-583, Capri, Italy, March 20-22, 2003. (pdf)

Gao, Y., Black, M. J., Bienenstock, E., Wu, W., Donoghue, J. P. (2003) A quantitative comparison of linear and non-linear models of motor cortical activity for the encoding and decoding of arm motions, *1st International IEEE/EMBS Conference on Neural Engineering,* pp. 189-192, Capri, Italy, March 20-22, 2003. (pdf)

Nicholas G. Hatsopoulos, Stuart Geman, Asohan Amarasingham, and Elie Bienenstock. At what time scale does the nervous system operate? *Neurocomputing* 52-54, pp. 25-29 (2003). (pdf)

Wu, W., Black, M. J., Mumford, D., Gao, Y., Bienenstock, E., and Donoghue, J. P. (2004) Modeling and decoding motor cortical activity using a switching Kalman filter. *IEEE Trans. Biomedical Engineering,* 51(6):933-942, (pdf)

Wei Wu, Yun Gao, Elie Bienenstock, John P. Donoghue, and Michael J. Black (2006) Bayesian Population Decoding of Motor Cortical Activity Using a Kalman Filter. *Neural Computation*, Volume 18, Number 1, pp. 80-118, (pdf)

Yun Gao, Ioannis Kontoyiannis, and Elie Bienenstock (2008) Estimating the Entropy of Binary Time Series: Methodology, Some Theory and a Simulation Study. *Entropy*, Volume 10, Number 2: 71-99. (pdf)

Michael Lamar, Yariv Maron, Mark Johnson, and Elie Bienenstock (2010). SVD and Clustering for Unsupervised POS Tagging. *Proceedings of the ACL 2010 Conference Short Papers*. Association for Computational Linguistics, Uppsala, Sweden, 215–219. Best Short Paper Award. (pdf)

Inbal Ayzenshtat, Elhanan Meirovithz, Hadar Edelman,Uri Werner-Reiss, Elie Bienenstock, Moshe Abeles, and Hamutal Slovin (2010). Precise spatio-temporal patterns among visual cortical areas and their relation to visual-stimulus processing. *The Journal of Neuroscience* (2010) 30(33):11232–11245. (pdf)

Michael Lamar, Yariv Maron and Elie Bienenstock (2010). Latent-Descriptor Clustering for Unsupervised POS Induction. *Proceedings of the 2010 Conference on Empirical Methods In Natural Language Processing*, Association for Computational Linguistics, Cambridge, MA, 799–809. (pdf)

Yariv Maron, Michael Lamar and Elie Bienenstock (2010). Sphere Embedding: An Application to Part-of-Speech Induction. *Advances in Neural Information Processing Systems 23*, edited by J. Lafferty, C. K. I. Williams, J. Shawe-Taylor, R.S. Zemel and A. Culotta, 1567–1575. (pdf)

d. NON-REFEREED JOURNAL ARTICLES

Neurophysiological Models, Spin Models, and Pattern Formation, with Michelle Schatzman, Technical Report PAM-240, Center for Pure and Applied Mathematics, University of California, Berkeley (1984).

Connectionist Approaches to Vision, Technical Report, Dept. of Developmental Neurobiology, Orsay University (1986).

A Cursory Introduction to the Physicists' Neural Networks, with Léon Personnaz, and Gérard Dreyfus, *Journal de Physique*, Paris, 50, pp. C3-207-208 (1989).

Comment on: *Neural Networks: A Review from a Statistical Perspective,* by B. Cheng and D.M. Titterington, with Stuart Geman, *Statistical Science,* 9, 36-38 (1994).

Comment on: *The Hebbian paradigm reintegrated: Local reverberations as internal representations,* by D.J. Amit, with Stuart Geman, *Behavioral and Brain Sciences*, 18 627-628 (1995).

On the temporal resolution of neural activity, with Akira Date and Stuart Geman, Technical Report, Division of Applied Mathematics, Brown University (1998).

A Gaussian mixture model for the motor cortical coding of hand motion, Wu, W., Mumford, D., Black, M. J., Gao, Y., Bienenstock, E., Donoghue, J. P., Neural Control of Movement, Santa Barbara, April 2003.

K-Winner-Take-All dynamics in random networks, Working document—June 19, 2018. Revised: June 2019. https://drive.google.com/drive/u/0/folders/1Uc5KTs_bcC-InyVmwnxyLXpJTo-i4K8S

e. PLENARY INVITED LECTURES SINCE 1988

Artificial Intelligence and Connectionist Models, Third French National Neuroscience Conference, Montpellier, France, May 9-12, 1989.

Neural Networks: From Biology to Statistics, 19th European Meeting of Statisticians, Barcelona, Spain, September 2-6, 1991.

f. INVITED LECTURES SINCE 1988

Relational Models in Natural and Artifical Vision. British Psychological Society Annual Conference, University of Leeds, U.K. April 15-18, 1988.

A Relational Approach in Object Recognition (with Stuart Geman and Donald Geman). Society for Industrial and Applied Mathematics SIAM Annual Meeting, Minneapolis, U.S.A., July 11-13, 1988.

Graph-Matching Approaches for Invariant Perception (with Yves Frégnac). C.O.D.E.S.T. Conference on *Basic Research in Adaptive Intelligence and Neurocomputing,* University of Oxford, UK, September 15-16, 1988.

The Dynamical Connectionist Approach to Knowledge Representation. Conference on *Connectionism in Perspective,* the Swiss Group for Artificial Intelligence and Cognitive Science, University of Zürich, Switzerland, October 10-13, 1988.

Computing with Dynamical Links. International Conference on: *Physics, Mathematics and Cognitive Neurosciences,* École Normale Superieure, Paris, France, January 24-27, 1989.

Of Shapes, Graphs, and Neural Codes. NATO Advanced Research Workshop on: *Neuro-computing, Algorithms, Architectures and Applications*, Les Arcs, France, February 27-March 3, 1989.

Une approche connexionniste de la vision des formes. Workshop on: *Perception Visuelle*, Societe Française de Psychologie, et Association pour la Recherche Cognitive. MRT, Paris, France, March 23-24, 1989.

Neural Networks and Nonparametric Statistical Inference (with Stuart Geman). Workshop on: *Neural Networks For Computing,* Snowbird, Utah, U.S.A. April 4-8, 1989.

Epigenése des représentations et sélection interne. Collége de France, Séminaire de la Chaire de Communications Cellulaires (Jean-Pierre Changeux), May 7, 1990.

Deformable Templates Realized by Neural Networks. Workshop on *Global Models for Image Analysis,* Center for Intelligent Control Systems (Brown University, Harvard University, M.I.T.), Providence, R.I., May 15, 1990.

Graph-Matching Approaches for Invariant Perception (with Yves Frégnac). C.O.D.E.S.T. Conference on *Basic Research in Adaptive Intelligence and Neurocomputing,* Dublin, Ireland, September 13-14, 1990.

Nouvelles théories sur le fonctionnement des réseaux neuronaux. Grand Colloque de Prospective du Ministére de la Recherche et de la Technologie : *Sciences de la Cognition,* Paris, January 28-31, 1991.

Neural Networks: Biological Relevance, Connections to Statistical Inference, Applications. Workshop on: *Stochastic Image Models, Markov Random Fields and Related Topics*, Invited Lecturer, Institute of Mathematics, Academia Sinica, Taipei, June 2-7, 1991.

Epigenetics of Neural Networks and Implications for Language. Center for Adaptive Systems, Boston University, February 4th, 1992.

Language and Brain: A Tentative Model. Center for Biological Information Processing, Whitaker College, MIT, February 26, 1992.

Hebbian Plasticity and Self-Organized Criticality. Neuroinformatik, Ruhr-Universität Bochum, FRG, November 11, 1992.

Self-Regulated Criticality in a Neural Network. Center for Neural Computation, Hebrew University in Jerusalem, Israel, February 4, 1993.

Neural Representations. Workshop on *Plurality of Mental Abilities: Evaluations and Variabilities,* Fondation des Treilles (Var), June 2-6, 1993.

Compositionality in Neural Networks. The Newton Institute (Cambridge, UK), *Programme on Vision (the Biology of Vision)*, August 16-20, 1993.

Le probléme de la compositionalité dans les réseaux de neurones. Workshop on *Modéles de la Cognition,* Fondation des Treilles (Var), October 25-29, 1993.

A synfire-based model of cortex. Center for Neural Computation, Hebrew University in Jerusalem, Israel, February 22, 1994.

Neural Theories of Compositionality. Fifth meeting on brain theory: *Theory and physiology of vision,* Trento, Italy, April 5-7, 1994.

Speculations about the mapping of language into neural activity patterns, Workshop on *Neural Assemblies and Cognition,* Tübingen, Germany, June 16-18, 1994

A Synfire-Based Model of Neocortex. Neuroinformatik, Ruhr-Universität Bochum, FRG, June 20, 1994.

A synfire-based model of the neocortex. Center for Research of Higher Brain Functions, Weizmann Institute, Rehovot, Israel, August 18, 1994.

Physiologie corticale et compositionalité des fonctions cognitives. Summer School *Géométrie et Vision,* Fondation des Treilles (Var), August 24-30, 1994.

Well-timed cortical events and language: some speculations. Meeting on *Brain Theory and Language Acquisition,* European Academy, Bolzano, Italy, September 1-3, 1994.

On the dynamics of synfire chains with high overlap. Invited lecture. International Conference on Cortical Dynamics, Jerusalem, Israel, June 11-15, 1995.

Compositionality in Neural Activity NIPS95 Workshop *Object Features for Visual Shape Representation,* Vail, Colorado, Decmber 1-2, 1995.

Algorithms of Synaptic Plasticity and Cell-Assembly Formation. Invited Lecture. International Symposium on *the Dynamics of Functional Connectivity in Visual Cortical Networks,* Royaumont, France, May 27-30, 1996.

Compositional Approaches to Vision and to the Modeling of Cortical Physiology. Department of Computation and Neural Systems, California Institute of Technology, June 11, 1996.

Compositionality, MDL Priors, and Object Recognition, with Stuart Geman, Neural Information Processing Systems (NIPS96), Denver, Colorado, December 3-5, 1996.

Mechanistic Relationships between Development and Learning: Beyond Metaphor. Dahlem Conference, Berlin, Germany, January 19-25, 1997.

Conditional independence in spike data: Testing for the role of fine temporal structure in binding. with Stuart Geman. Neural Information Processing Systems (NIPS97), Workshop on Neurostatistics of Cell Assemblies, Breckenridge, Colorado, December 5, 1997.

Devising Statistical Tests for Fine Temporal Structure, with Stuart Geman and Akira Date. International Titisee Conference on *The Role of Time in Neuronal Processing*. Titisee/Black Forest, Germany, May 4-8, 1998.

Computing with Fast Functional Links, European-Science-Foundation Summer Symposium on Neural Computation and Neuroinformatics. Trieste, Italy, September 4-6, 1999.

Distributed Synchrony Without Cycles, Center for Computational Neuroscience, Tel-Aviv University, Israel, January 17, 2000.

A Compositional Model for Vision, Interdisciplinary Center for Neural Computation, Hebrew University, Jerusalem, Israel, January 20, 2000.

Compositional Cortical Codes, Brown University Symposium: *The Dynamic Brain-Molecules Mathematics and the Mind*, May 31-June 3, 2000.

Issues in the Modeling of Cortical Activity, HIACS/Rothschild Joint Workshop: *Neural Computation-Computational/Mathematical Problems (and Solutions?) Arising from Neurophysiology*, Haifa University, Israel, January 14-15, 2001.

The Use of Mathematics in Brain Studies, Denver Brown Alumni Club, May 10, 2001; Philadelphia Brown Alumni Club, May 23, 2001.

Temporal Coding in the Brain, Cold Spring Harbor Laboratory Workshop (Jeff Jawkins, Bruce Stillman, John Hopfield), July 30, 2001.

Voyages of Discovery: The Machine Inside, with David Sheinberg and Michael Black, Inauguration of President Ruth Simmons, Brown University, October 13, 2001.

Hierarchical Bayesian Brain Models, In: *From Neuron to Mind*, The Multidisciplinary Brain Research Center, Bar-Ilan University, Tel-Aviv, Israel, June 14-17 2004.

Composition Systems for Vision, Weizmann Institute, Department of Computer Science and Applied Mathematics, June17, 2004.

Using relational information in models of visual perception, Scientific workshop in honor of Chirstoph von der Malsburg: *Towards a Science of Organization*. Ruhr Universität, Bochum, Germany, July 7, 2006.

Nonlinear dendritic integration and coincidence detection: First steps towards a model of invariant visual perception. Workshop on *Dynamical Modelling and Data Analysis of Cortical Networks*, University of Ulm, Germany, October 8 – 11, 2006

Neural modeling of language: challenges and directions, Linguistics Colloquium, Bar-Ilan University, Israel, April 17, 2007.

Dynamics of synaptic motifs and modeling of natural language, Complexity in Neural Network Dynamics, Gif-sur-Yvette, France, December 13, 2007.

Motif-Based Brain Models—Attempting to Reverse-Engineer The Faculty of Language, Electrical and Computer Engineering Colloquium, U Mass, Dartmouth, April 7, 2008.

Network motifs in a model of visual cortex, Unit of Neuroscience, Information and Complexity (UNIC), CNRS, Gif-sur-Yvette, France, April 24, 2014.

g. PAPERS READ AND POSTERS PRESENTED SINCE 2003

A Gaussian mixture model for the motor cortical coding of hand motion, Wu, W., Mumford, D., Black, M. J., Gao, Y., Bienenstock, E., Donoghue, J. P., Neural Control of Movement, Santa Barbara, April 2003.

Committed Complex Cells, Elie Bienenstock, Anastasia Anishchenko and Stuart Geman, Computational Neuroscience CNS*2003 Alicante, Spain July 5-9, 2003.

Associative-memory retrieval and spontaneous activity bumps in small-world networks of integrate-and-fire neurons. Anastasia Anishchenko, Alessandro Treves and Elie Bienenstock, Sixth IBRO (International Brain Research Organization) World Congress of Neuroscience, Prague, Czech Republic, July 10 - 15, 2003.

Lempel-Ziv and CTW Entropy Estimators for Spike Trains. Yun Gao, Yiannis Kontoyiannis and Elie Bienenstock, NIPS03 Workshop on Estimation of entropy and information of undersampled probability distributions—Theory, algorithms, and applications to the neural code, Whistler, British Columbia, Canada, December 12th, 2003.

Predicting leftward and rightward hand movements with EEG on single-trials. Archibald R, O'Keefe T, Bienenstock E, Sanes JN (2005) Program No. 401.12. 2005 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2005. Online.

Neocortical self-structuration as a basis for learning. Doursat, R. & Bienenstock, E. (2006) 5th International Conference on Development and Learning (*ICDL 2006*), May 31-June 3, 2006, Indiana University, Bloomington, Indiana. (pdf)

Single-trial prediction of discrete hand movements with electroencephalography. Jerome N. Sanes, Timothy O'Keefe, Richard Archibald, Elie Bienenstock, *Abstract, Human Brain Mapping 2006.* (pdf)

The self-organization of synfire patterns. René Doursat and Elie Bienenstock. 10th International Conference on Cognitive and Neural Systems (ICCNS), Boston University, Massachusetts, May 17-20, 2006. (pdf)

Representation and Computation in Natural Vision, E. Bienenstock, S. Geman, M.A. Paradiso, D. Sheinberg, Britt Anderson, Eran Borenstein, Gideon Shalev, Yanchun Wu. Workshop on *Visual Learning and Recognition*, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, May 23, 2006.

Representation and Computation in Natural Vision, E. Bienenstock, S. Geman, M.A. Paradiso, D. Sheinberg, Britt Anderson, Eran Borenstein, Gideon Shalev, Yanchun Wu. *CRCNS Contractors meeting*, Washington DC, June 5, 2006.

Spatial correlations among neuronal populations in the visual cortex of a behaving monkey, I. Ayzenshat, E. Meirovithz, E. Bienenstock, M. Abeles, and H. Slovin. Neuroscience 2007, San Diego, Nov 4, 2007.

Decoding natural images from precise spatio-temporal patterns among neuronal populations in the visual cortex of behaving monkeys, Ayzenshtat I., Meirovithz E., Werner-Reiss U., Bienenstock E., Abeles M. and Slovin H., The Israel Society for Neuroscience 17th Annual Meeting Eilat, Dec. 7 - 9, 2008.

SVD and Clustering for Unsupervised POS Tagging, Michael Lamar, Yariv Maron, Mark Johnson, and Elie Bienenstock, Association for Computational Linguistics, Uppsala, Sweden, July 11-16, 2010.

Latent-Descriptor Clustering for Unsupervised POS Induction. Michael Lamar, Yariv Maron and Elie Bienenstock, Empirical Methods in Natural Language Processing, Cambridge, MA, October 9-11, 2010

Sphere Embedding: An Application to Part-of-Speech Induction. Yariv Maron, Michael Lamar and Elie Bienenstock. Neural Information Processing Systems, Vancouver, December 6-9, 2010.

6. RESEARCH GRANTS

Completed:

DARPA – Mathematics of Sensing, Exploitation and Execution (MSEE): "Hierarchical representations for the evaluation of sensed data." October 1, 2011 to March 31, 2015. PI: Stuart Geman, Co-PIs: Elie Bienenstock, Matthew Harrison, Donald Geman, Lo-Bin Chang, Laurent Younes.

Human Frontier Sciences Project, Grant Number: RG 0103/1998B (PI Mark F. Bear), "The Synaptic Basis of Receptive Field Plasticity," 5/1/98-4/30/01, Co-Investigator.

NSF-ITR, Grant Number: EIA-0113679 (PI: Michael Black), "The Computer Science of Biologically-Embedded Systems," Sept. 2001 — Sept. 2004. Role: Co-PI.

NINDS, Contract Number: N01–NS–2–2345 (PI: John Donoghue), "Cortical Control of Neural Prostheses," 09/30/02-09/29/05. Role: Co-Investigator.

DARPA, Contract Number MDA972-00-1-0026 (PI: Arto Nurmikko), "Coupling of Brain with microstructured electronic/ optoelectronic arrays: Interactive Computation at the bio/info/micro interface" 7/17/00-7/16/05. Role: Co-Investigator

NIH-NINDS, Grant Number: 2R37NS025074-14 (PI: John Donoghue), "Static and Dynamic Organization of Primate Cortex," July 1987—April 2006. Role: Co-Investigator.

NIH-NINDS, Grant Number RO1-NS44834 (PI: Jerome Sanes), "Cognition and Action," 10/1/02-6/30/05. Role: Co-Investigator.

NSF, Grant Number 0423031, CRCNS: Representation and Computation in Natural Vision, Sept. 2004 — Aug. 2007. PI: Stuart Geman. Co-PIs: Elie Bienenstock, David Sheinberg, Michael A. Paradiso.

NIH, Grant Number R01-NS050967, CRCNS: Learning the Neural Code for Prosthetic Control, Aug. 2004 — May 2007. PI: Michael Black. Co-PIs: Elie Bienenstock, Mayank Mehta, John Donoghue.

7. SERVICE

i. TO THE UNIVERSITY

1. Member of following Committees:

        o   Brain Sciences Program Executive Committee
        o   Neuroscience Graduate Program Training Committee
        o   Neuroscience Undergraduate Curriculum Committee (NUCC)
        o   Graduate Council
2. Neuroscience Concentration Advisor
3. Applied Mathematics Concentration Advisor
4. Applied Mathematics-Biology Concentration Advisor
5. Freshman Advisor

ii.   TO THE PROFESSION

Co-organizer: NATO Workshop on *Disordered Systems and Biological Organization*, Les Houches, France, March 1985.

Co-organizer: Interdisciplinary Workshop on *Compositionality in Cognition and Neural Networks*, Abbaye de Royaumont, France, May 1991.

Co-organizer: Interdisciplinary Workshop on *Compositionality in Cognition and Neural Networks*, Abbaye de Royaumont, France, June 1992.

Member, Fachbeirat (Scientific Advisory Board, with site visits), Max-Planck-Institut für Hirnforschung, Frankfurt, Germany.

Member, Comité National des Neurosciences (Scientific Advisory Board, with site visits throughout country), CNRS, France.

Referree for: Neural Computation; Neural Networks; Network-Computation in Neural Systems; Physica D; J. Neurophys.; Phys. Rev.; Phys. Rev. Lett.; IEEE Trans. on Neural Networks; Visual Neuroscience; International Conference on Artificial Neural Networks (ICANN); Journal of Computational Neuroscience, PloS Computational Biology; PNAS; SIAM Journal on Applied Dynamical Systems (SIADS).

Member, Editorial Board: Neural Networks; Network-Computation in Neural Systems.

Grant Reviewer: Israel Science Foundation; European Science Foundation; Ministére de la Recherche et de l'Education Nationale, France; Max-Planck Society, Germany; German-Israeli Science Foundation (GIF).

Review Panel on Collaborative Research in Computational Neuroscience, joint NSF-NIH program, Wachington DC, March 3-4, 2005.

Annual Site Visit of CELEST (Center of Excellence for Learning in Education, Science, and Technology), NSF Science of Learning Center (SLC), Boston, June 19-21 2005.

NIH Review Panel on *Predictive Multiscale Models on the Physiome in Health and Disease* (2008).

Consulting: Industrial Automation: developed algorithms for widely used Optical-Character-Recognition software (Mathematical Technologies Inc, Providence).

US Patent 10/455,509 "Method and System for Inferring Hand Motion From Multi-Cell Recordings in the Motor Cortex Using a Kalman Filter or Bayesian Model," Application filed 06/04/2003, Co-Inventor with Michael Black, Wei Wu, and Yun Gao.

Consulting: Dynamic-Programming approach for signal analysis arising in semiconductor-manufacturing application (InnerSense Ltd., Jerusalem).

8. **TEACHING SINCE 1996**

Statistical Analysis of Time Series, AM167, Spring **1996**.

Mathematical Techniques for Neural Modeling, AM281-Neurosciences BN293, Fall **1996**.

Operations Research: Probabilistic Models, AM120, Spring **1998**, Enrollment: 22.

M.Sc thesis, **1999**: Asohan Amarasingham (Cognitive and Linguistic Sciences).

Statistical Analysis of Time Series, AM167, Spring **2000**, Enrollment: 10.

Short Course on Models of Brain Function, Center for Neural Computation, Hebrew University, Jerusalem, Israel, January **2000**.

Methods of Applied Mathematics, II, AM34, Fall **2000**, Enrollment: 14.

Operations Research: Probabilistic Models, AM120, Spring **2001**, Enrollment: 21.

Statistical Analysis of Time Series, AM167, Fall **2001**, Enrollment: 17.

Computational Neuroscience, BN168, Spring **2002**, Enrollment: 7.

Statistical Inference I, AM165, Fall **2002**, Enrollment: 61.

Honors thesis **2002**: Phoenix Kalen (Applied Mathematics).

Computational Neuroscience, BN168, Spring **2003**, Enrollment: 12

Independent Study, AM196, Spring **2003**, Enrollment: 1

Statistical Inference I, AM165, Fall **2003**, Enrollment: 102.

Computational Neuroscience, BN168, Spring **2004**, Enrollment: 9

Research Talk Lab (co-taught with Andrea Simmons), Spring **2004**, Enrollment: 9

Statistical Inference I, AM165, Fall **2004**, Enrollment: 77

Independent Study, AM195, Fall **2004**, Enrollment: 2

Computational Neuroscience, BN168, Spring **2005**, Enrollment: 6

Statistical Inference I, AM165, Fall **2005**, Enrollment: 99.

Computational Neuroscience, BN168, Spring **2006**, Enrollment: 6

Mathematical Methods in the Brain Sciences, AM 0041, Fall **2007**, Enrollment: 17.

Computational Neuroscience, NEUR 1680, Spring **2008**, Enrollment: 14

Mathematical Methods in the Brain Sciences, APMA 0410, Fall **2008**, Enrollment: 9.

Computational Neuroscience, NEUR 1680, Spring **2009**, Enrollment: 8

Mathematical Methods in the Brain Sciences, APMA0410, Fall **2009**, Enrollment: 18.

Computational Neuroscience, NEUR 1680, Spring **2010**, Enrollment: 15

Mathematical Methods in the Brain Sciences, APMA0410, Fall **2010**, Enrollment: 22.

Computational Neuroscience, NEUR 1680, Spring **2011**, Enrollment: 12

Statistical Inference II, APMA 1660, Spring **2012**, Enrollment: 68.

Computational Neuroscience, NEUR 1680, Spring **2012**, Enrollment: 7.

Mathematical Methods in the Brain Sciences, APMA0410, Fall **2012**, Enrollment: 10.

Computational Neuroscience, NEUR 1680, Spring **2013**, Enrollment: 14.

Mathematical Methods in the Brain Sciences, APMA0410, Fall **2013**, Enrollment: 15.

Research in Applied Mathematics, APMA 2980, Fall **2013**, Enrollment: 1.

Independent Study in Applied Mathematics, APMA 1970, Fall **2013**, Enrollment: 1.

Independent Study in Neuroscience, NEUR 1970, Fall **2013**, Enrollment: 1.

Research in Applied Mathematics, APMA 2980, Spring **2014**, Enrollment: 1.

Independent Study in Neuroscience, NEUR 1970, Spring **2014**, Enrollment: 1.

Computational Neuroscience, NEUR 1680, Spring **2015**, Enrollment: 10

Stochastic Models of Neuronal Networks, APMA 1930N, Fall **2015**, Enrollment: 7

Research in Applied Mathematics, APMA 2980, Fall **2015**, Enrollment: 1

Introduction to Computational Neuroscience, NEUR 0680, Spring **2016**, Enrollment: 21.

Research in Applied Mathematics, APMA 2980, Spring **2016**, Enrollment: 1.

Mathematical Models of Cortical Dynamics, APMA1930Q, Fall **2016**, Enrollment: 9.

Introduction to Computational Neuroscience, NEUR 0680, Spring **2017**, Enrollment: 13.

Quantitative Models of Biological Systems, APMA 1070, Fall **2017**, Enrollment: 27.

Introduction to Computational Neuroscience, NEUR 0680, Spring **2018**, Enrollment: 12.

Independent Study in Applied Mathematics, APMA 1970, Spring **2018**, Enrollment:1

Introduction to Computational Neuroscience, NEUR 0680, Fall **2018**, Enrollment: 4.

Independent Study in Applied Mathematics, APMA 1970, Fall **2018**, Enrollment:2

Quantitative Models of Biological Systems, APMA 1070, Spring **2019**, Enrollment: 32.

Independent Study in Applied Mathematics, APMA 1970, Spring **2019**, Enrollment:2

Computational Neuroscience, NEUR 1680, Fall **2019**, Enrollment: 4.

Ph.D students:
René Doursat (Université Paris 6, France, June 1991)
Yun Gao (Applied Mathematics, Brown University, June 2004)
Anastasia Anishchenko (Physics, Brown University, November 2005)

Britt Anderson (Brain Science Program, Brown University, November 2005)
Michael Lamar (Applied Mathematics, Brown University, May 2010)
Yariv Maron (Brain Research Program, Bar-Ilan University, Israel, 2011)