Name: Tomaso A. Poggio

Professional Title and Affiliation: The Eugene McDermott Professor
Department of Brain and Cognitive Sciences
McGovern Institute
CSAIL (Computer Science and Artificial Intelligence Lab)
Massachusetts Institute of Technology

Business Address: Department of Brain and Cognitive Sciences
Massachusetts Institute of Technology
Brain and Cognitive Sciences Department
M.I.T., 46-5177B,
43 Vassar Street
Cambridge, MA 02142

Business Phone: 617 253 2530
Business Fax: 617 253 2964
E-mail: tp@ai.mit.edu

50-WORD STATEMENT

Tomaso Poggio is one of the founders of computational neuroscience. He pioneered models of the fly's visual system and of human stereovision, introduced regularization theory to computational vision, made key contributions to the biophysics of computation and to learning theory, developed an influential model of recognition in the visual cortex.

CURRICULUM VITAE

Tomaso A. Poggio, is the Eugene McDermott Professor at the Department of Brain and Cognitive Sciences; Co-Director, Center for Biological and Computational Learning; Member of the Computer Science and Artificial Intelligence Laboratory at MIT; since 2000, member of the faculty of the McGovern Institute for Brain Research. Born in Genoa, Italy in 1947 (and naturalized in 1994), he received his Doctor in Theoretical Physics from the University of Genoa in 1971 and was a Wissenschaftlicher Assistant, Max Planck Institut für Biologische Kybernetik, Tüebingen, Germany from 1972 until 1981 when he became Associate Professor at MIT. He is an honorary member of the Neuroscience Research Program, a member of the American Academy of Arts and Sciences and a Founding Fellow of AAAI. He received several awards such as the Otto-Hahn-Medaille Award of the Max-Planck-Society, the Max Planck Research Award (with M. Fahle), from the Alexander von Humboldt Foundation, the MIT 50K Entrepreneurship Competition Award, the Laurea Honoris Causa from the University of Pavia in 2000 (Volta Bicentennial), the 2003 Gabor Award, the 2009 Okawa prize and 2009 Okawa prize and the American Association for the Advancement of Science (AAAS) Fellowship (2009). He is one of the most cited computational neuroscientists (with a h-index greater than 90 – based on GoogleScholar). He is somewhat unique in having a significant impact in most areas of sciences, with for instance a h-index = 35 in social sciences and around 20 in business (as remarked in the Via-academy list with the note 'most eclectic scientist').

STATEMENT OF ACCOMPLISHMENTS

Tomaso Poggio is a computational neuroscientist whose contributions range from the biophysical and behavioral studies of the visual system to the computational analyses of vision and learning in humans and machines.

With W. Reichardt, Poggio characterized quantitatively the visuo-motor control system in the fly, deriving. equations that could predict the fly's tracking and fixation behavior. He also modeled the fly's neural circuitry underlying the detection of motion boundaries, connecting it to behavior and physiology, pioneering normalization circuits, later used for visual cortex.

With D. Marr, Poggio characterized necessary levels of analysis in computational neuroscience and developed stereo algorithms which served as the primary model of stereopsis and as exemplar for other vision algorithms in the field. At the biophysical level, Poggio and coworkers pioneered models suggesting that dendritic trees and synapses have a key computational role – a view now receiving experimental confirmation. At the level of computation, Poggio introduced regularization theory as a general framework to solve the ill-posed problems of vision.

His most cited papers describe seminal contributions to learning theory where Poggio developed the mathematics of Regularization Networks. He applied learning techniques to bioinformatics, to computer graphics, computer vision and to neuroscience e.g. to decrypt the neural code in IT.

In the last decade he has worked on a hierarchical extension of learning developing a feedforward quantitative model of visual recognition in the visual cortex which has been a useful tool to drive and interpret several physiological experiments, and is consistent with human performance in rapid categorization and suggests novel architectures to the field of computer vision, based on neuroscience of vision. The citation for the recent 2009 Okawa prize mentions his "…outstanding contributions to the establishment of computational neuroscience, and pioneering researches ranging from the biophysical and behavioral studies of the visual system to the computational analysis of vision and learning in humans and machines."

PRINCIPAL CONTRIBUTIONS TO SCIENCE

Chikkerur, S., T. Serre, C. Tan, and T. Poggio, "What and Where: A Bayesian inference theory of visual attention", *Vision Research*, [doi: 10.1016 /j.visres.2010.05.013], May 20, 2010

Jhuang, H., E. Garrote, J. Mutch, X. Yu, V. Khilnani, T. Poggio, A.D. Steele, and T. Serre."Automated home-cage behavioural phenotyping of mice. *Nature Communications,*" 1, Article 68, [doi: 10.1038/ncomms1064], September 7, 2010. Click here for software documentation.

Smale, S., L. Rosasco, J. Bouvrie, A. Caponnetto, and T. Poggio, "Mathematics of the Neural Response", *Foundations of Computational Mathematics*, Vol. 10, 1, 67-91, June 2009 (online); February 2010 (print)

Kouh, M. and T. Poggio. "A Canonical Neural Circuit for Cortical Nonlinear Operations" *Neural Computation*, June 2008, Vol. 20, No. 6, Pages 1427-1451

Cadieu, C., M. Kouh, A. Pasupathy, C. Connor, M. Riesenhuber, and T. Poggio. A Model of V4 Shape Selectivity and Invariance, *Journal of Neurophysiology,* Vol. 98, 1733-1750, June, 2007.

Serre, T., A. Oliva and T. Poggio. A Feedforward Architecture Accounts for Rapid Categorization, *Proceedings of the National Academy of Sciences (PNAS)*, Vol. 104, No. 15, 6424-6429, 2007.

Hung, C.P., G. Kreiman, T. Poggio and J.J. DiCarlo. Fast Readout of Object Identity from Macaque Inferior Temporal Cortex, *Science*, Vol. 310, 863-866, 2005.

Yeo, G., E. Van Nostrand, D. Holste, T. Poggio and C.B. Burge. Identification and Analysis of Alternative Splicing Events Conserved in Human and Mouse, *Proceedings of the National Academy of Sciences (PNAS)*, 102, 8, 2850-2855, 2005.

Lampl, I., D. Ferster, T. Poggio and M. Riesenhuber. Intracellular Measurements of Spatial Integration and the MAX Operation in Complex Cells of the Cat Primary Visual Cortex, *Journal of Neurophysiology*, 92, 2704-2713, 2004.

Poggio, T. and E. Bizzi. Generalization in Vision and Motor Control, *Nature*, Vol. 431, 768-774, 2004.

Poggio, T., R. Rifkin, S. Mukherjee and P. Niyogi. General Conditions for Predictivity in Learning Theory, *Nature*, Vol. 428, 419-422, 2004.

Giese, M. and T. Poggio. Neural Mechanisms for the Recognition of Biological Movements, *Nature Neuroscience Review*, Vol. 4, 179-192, March 2003.

Poggio, T. and S. Smale. The Mathematics of Learning: Dealing with Data, *Notices of the American Mathematical Society (AMS)*, Vol. 50, No. 5, 537-544, 2003. (See journal issue at AMS Notices.)

Ezzat, T., G. Geiger and T. Poggio. "Trainable Videorealistic Speech Animation," *ACM SIGGRAPH 2002*, San Antonio, TX, July 2002.

Freedman, D.J., M. Riesenhuber, T. Poggio and E.K. Miller. Categorical Representation of Visual Stimuli in the Primate Prefrontal Cortex, *Science*, 291, 312-316, 2001.

Evgeniou, T., Pontil, M. and T. Poggio. Regularization Networks and Support Vector Machines, *Advances in Computational Mathematics*, 13, 1, 1-50, 2000.

Riesenhuber, M., and T. Poggio. Models of Object Recognition, *Nature Neuroscience*, 3 Supp., 1199-1204, 2000.

Riesenhuber, M. and T. Poggio. Hierarchical Models of Object Recognition in Cortex, *Nature Neuroscience*, 2, 1019-1025, 1999.

Sung, K.K. and T. Poggio. Example-Based Learning for View-Based Human Face Detection, IEEE PAMI, Vol. 20, No. 1, 39-51, 1998.

Beymer, D. and T. Poggio. Image Representation for Visual Learning, *Science*, 272, 1905-1909, 1996.

Sinha, P. and T. Poggio. Role of Learning in Three-dimensional Form Perception, *Nature*, Vol. 384, No. 6608, 460-463, 1996.

Logothetis, N.K, J. Pauls, and T. Poggio. Shape Representation in the Inferior Temporal Cortex of Monkeys, *Current Biology*, Vol. 5, No. 5, 552-563, 1995.

Brunelli, R. and T. Poggio. Face Recognition: Features Versus Templates, *IEEE PAMI*, 15, 1042-1052, 1993.

Poggio, T., M. Fahle and S. Edelman. Fast Perceptual Learning in Visual Hyperacuity, *Science*, 256, 1018-1021, May 1992.

"A Theory of How the Brain Might Work," (T. Poggio). In: Proceedings of Cold Spring Harbor Symposia on Quantitative Biology, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 4, 899-910, 1990.

Poggio, T. and F. Girosi. Networks for Approximation and Learning, *Proceedings of the IEEE* (special issue: Neural Networks I: Theory and Modeling), Vol. 78, No. 9, 1481-1497, September 1990.

Edelman, S. and T. Poggio. A Network that Learns to Recognize 3D Objects, *Nature*, 343, 263-266, 1990.

Poggio, T. and F. Girosi. Regularization Algorithms for Learning that are Equivalent to Multilayer Networks, *Science*, 247, 978-982, 1990.

Bülthoff, H.H., J. Little and T. Poggio. A Parallel Algorithm for Real Time Computation of Optical Flow, *Nature*, 337, 549-553, 1989.

Bertero, M., T. Poggio and V. Torre. Ill-posed Problems in Early Vision, *Proceedings of the IEEE*, 76, 869-889, 1988.

Poggio, T., E. Gamble and J. Little. Parallel Integration of Vision Modules, *Science*, 242, 436-440, 1988.

Voorhees, H. and T. Poggio. Computing Texture Boundaries from Images, *Nature*, 333, 364-367, 1988.

Hurlbert, A. and T. Poggio. Synthesizing a Color Algorithm from Examples, *Science*, 239, 482-485, 1988.

Poggio, T. and C. Koch. Synapses that Compute Motion, *Scientific American*, 256, 46-52, 1987.

Marroquin, J., S. Mitter and T. Poggio. Probabilistic Solution of Ill-posed Problems in Computational Vision, *Journal of American Statistical Association*, 82, 76-89, 1987

Hurlbert, A. and T. Poggio. Do Computers Need Attention?, *Nature*, 321, 651-652, 1986.

Poggio, T. Vision by Man and Machine, *Scientific American*, 250, 106-116, 1984.

Poggio, G. and T. Poggio. The Analysis of Stereopsis, *Annual Review of Neuroscience*, 7, 379-412, 1984.

Koch, C., T. Poggio and V. Torre. Nonlinear Interactions in a Dendritic Tree: Localization, Timing and Role in Information Processing, *PNAS*, 80, 2799-2802, 1983.

Poggio, T., V. Torre and C. Koch. Computational Vision and Regularization Theory, *Nature*, 317, 314-319, 1985.

Nishihara, H.K. and T. Poggio. Hidden Cues in Random-line Stereograms, *Nature*, 300, 347-349, 1982.

Koch, C., T. Poggio and V. Torre. Retinal Ganglion Cells: A Functional Interpretation of Dendritic Morphology, *Proceedings of the Royal Society London,* 298, 227-264, 1982.

Fahle, M. and T. Poggio. Visual Hyperacuity: Spatiotemporal Interpolation in Human Vision, *Proceedings of the Royal Society London B*, 213, 451-477, 1981.

Poggio, T., W. Reichardt and W. Hausen. A Neuronal Circuitry for Relative Movement Discrimination by the Visual System of the Fly, *Naturwissenschaften*, 68, 9, 443-466, 1981.

Torre, V. and T. Poggio. A Synaptic Mechanism Possibly Underlying Directional Selectivity Motion., *Proceedings of the Royal Society London B*, 202, 409-416, 1978.

"From Understanding Computation to Understanding Neural Circuitry," (D. Marr and T. Poggio). In: Neuronal Mechanisms in Visual Perception, E. Poppel, R. Held and J.E. Dowling (eds.), Neurosciences Res. Prog. Bull., 15, 470-488, 1977.

Marr, D., and T. Poggio. Cooperative Computation of Stereo Disparity, *Science*, 194, 283-287, 1976.

Wehrhahn, C. and T. Poggio. Real-time Delayed Tracking in Flies, *Nature*, 261, 43-44, 1976.

Reichardt, W. and T. Poggio. Visual Control of Orientation Behavior in the Fly. : A Quantitative Analysis., *Quarterly Review of Biophysics*, 3, 311-375, 1976.

Marr, D., and T. Poggio. Cooperative Computation of Stereo Disparity., *Science*, 194, 283-287, 1976.

Geiger, G. and T. Poggio. The Muller-Lyer Figure and the Fly, *Science*, 190, 479-480, 1975.