BIOMEDICAL ENGINEERING

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PAUL SAJDA

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EDUCATION

- 1989: B.S., Electrical Engineering, Massachusetts Institute of Technology

- 1992: M.S., Bioengineering, University of Pennsylvania

- 1994: Ph.D., Bioengineering, University of Pennsylvania

AWARDS/HONORS

- Elevated to Senior Member of the IEEE 2006

- NSF CAREER Award 2002

- Sarnoff Technical Achievement Award—Computer Aided Diagnosis 1996

- Solomon R. Pollack Award for the Outstanding PhD Dissertation in Bioengineering (University of Pennsylvania, 1994)

- Louis and Josepha B. Flexner Award for the Outstanding Ph.D. Dissertation in the Neurosciences (University of Pennsylvania, 1993)

- Office of Naval Research National Defense Science and Engineering Graduate Fellow (1991-94)

- University Fellow (University of Pennsylvania, 1989-90)

- David Alder Memorial Thesis Prize for Outstanding Undergraduate Thesis Research in Electrical Engineering (MIT, 1989)

- Eta Kappa Nu

WORK EXPERIENCE

- 1999-2000: Head, Adaptive Image and signal Processing, Sarnoff Corporation, Princeton NJ

RESEARCH SUMMARY

The approach behind my research is fundamentally grounded in Neural Engineering, utilizing large-scale computational modeling and advanced neuroimaging to infer circuitry and circuit properties of visual cortex. Neural engineering is an emerging interdisciplinary field of research that uses engineering techniques to investigate the function of and manipulate the behavior of the central or peripheral nervous system. The field draws heavily on computational neuroscience, experimental neuroscience, electrical engineering, clinical neurology and signal processing, as well as encompassing elements of robotics, computer engineering, tissue engineering, materials science and nanotechnology.

My research has led to the development of several innovative systems under what can be termed applied neuroscience, e.g. brain computer interfaces for image search and computer-assisted detection systems for medical image analysis. My philosophy, "build it, measure it, test it, understand it", is partly fostered by my six years of industrial R&D experience at the Sarnoff Research Center in Princeton, NJ.

I am the director of the Laboratory for Intelligent Imaging and NeuroComputing (LIIINC).

PUBLICATIONS (SELECTED OVER THE PAST 3 YEARS)

- P. Sajda and K. Baek (2004) Integration of form and motion within a generative model of visual cortex, (invited submission) Neural Networks: Special Issue on Vision and Brain, 17 (5/6) 809-821. Also in Vision and Brain: How the Brain Sees / New Approaches to Computer Vision, edited by S. Grossberg, L. Finkel and D. Field. Elsevier, 2004.

- P. Sajda, S. Du, T.R. Brown, R. Stoyanova, D.C. Shungu, X. Mao, and L.C. Parra (2004) Non-negative matrix factorization for rapid recovery of constituent spectra in magnetic resonance chemical shift imaging of the brain, IEEE Transactions on Medical Imaging, 23(12): 1453-1465.

- L.C. Parra, C.D. Spence, A.D. Gerson and P. Sajda (2005) Recipes for the linear analysis of EEG, NeuroImage 28(2): 326-41.

- J. Wielaard and P. Sajda (2005) Neural mechanisms of contrast dependent receptive field size in V1, Advances in Neural Information Processing Systems 18, Ed. Y. Weiss and B. Scholkopf and J. Platt. MIT Press, Cambridge, MA, 1505-1512.

- A.D. Gerson, L.C. Parra, and P. Sajda (2005) Cortical origins of response time variability during rapid discrimination of visual objects, NeuroImage. 28(2): 342-53.

- M.G. Philiastides and P. Sajda (2005) Temporal characterization of the neural correlates of perceptual decision making in the human brain, Cerebral Cortex. 16(4): 509-518, Apr. 2006. (cover article)

- C. Spence, L. Parra and P. Sajda (2006) Varying complexity in tree structured distribution models, IEEE Transactions on Image Processing, 15(2): 319- 330.

- A. Luo and P. Sajda (2006) Learning discrimination trajectories in EEG sensor space: Application to inferring task difficulty, Journal of Neural Engineering, 3(1):L1-L6.

- M.G. Philiastides, R. Ratcliff and P. Sajda (2006) Neural representation of task difficulty and decision making during perceptual categorization: a timing diagram, Journal of Neuroscience, 26(35): 8965-75. (cover article)

- P. Sajda (2006) Machine learning for detection and diagnosis of disease, Annual Review of Biomedical Engineering, (invited). Vol 8, 537-565.

- A.D. Gerson, L.C. Parra and P. Sajda (2006) Cortically-coupled computer vision for rapid image search, Neural Systems and Rehabilitation Engineering, IEEE Transactions on. 14(2) 174-179.

- J. Wielaard and P. Sajda (2006) Circuitry and the classification of simple and complex cells in V1, Journal of Neurophysiology, published online June 21, 2006 doi:10.1152/jn.00346.2006. 96(5) 2739-2749.

- J. Wielaard and P. Sajda (2006) Extraclassical receptive field

phenomena & short-range connectivity in V1. Cerebral Cortex, published online Dec 22, 2005. doi:10.1093/cercor/bhj090 vol 16:11, 1531-1545. (cover article)

- Q. Zhao, R. Stoyanova, S. Du, P. Sajda, T.R. Brown (2006) HiRes - A Tool for Comprehensive Assessment and Interpretation of Metabolomic Data, Bioinformatics 22:20, 2552-2554.

- M.G. Philiastides and P. Sajda (2006) Causal influences in the human brain during face discrimination: a short-window directed transfer function approach, IEEE Transactions on Biomedical Engineering, 53(12), 2602-2605.

- S. Du, X. Mao, P. Sajda and D. Shungu (2007) Automated Tissue Segmentation and Blind Recovery of 1H MRSI Spectral Patterns of Normal and Diseased Human Brain, NMR in Biomedicine doi:10.1002/nbm.1151.

- L.C. Parra, C. Christoforou, A. D. Gerson, M. Dyrholm, A. Luo, M. Wagner, M. G. Philiastides, P. Sajda (2007) Spatio-temporal linear decoding of brain state: Application to performance augmentation in high-throughput tasks, IEEE Signal Processing Magazine, accepted for publication.

- J. Wielaard and P. Sajda (2007) Dependence of response properties on sparse connectivity in a spiking neuron model of the lateral geniculate nucleus, Journal of Neurophysiology, in press.

- Christoforos Christoforou, Paul Sajda, Lucas C. Parra, (2007) Second Order Bilinear Discriminant Analysis for Single -trial EEG", Advances in Neural Information Processing Systems 21, 2007 in press.

- M.G. Philiastides and P. Sajda (2007) EEG-Informed fMRI Reveals Spatiotemporal Characteristics of Perceptual Decision Making, Journal of Neuroscience, (in press)

- [View the complete list of publications.](#)

ACTIVE FUNDING

A Large-Scale Spiking Neuron Model of Visual Cortex as a Substrate for Optimizing Visual Perception, HM1582-07-1-2002 (Sajda, PI), NGA $513,627 3/07-2/10

Cortically-Coupled Computer Vision, HM1582-05-C-0043 (Sajda, PI), DARPA /NGA $1,064,288 10/05-9/07

Bayesian Cortical Networks for Contextual Integration, HM1582-05-C-0008 (Sajda, PI) NGA $977,000 10/04-9/09

A Non-invasive Single-trial In Vivo Neuroimaging System (R21/R33 EB004730) (Sajda, PI) NIH/NIBIB $1.470,000 8/04-7/08

TEACHING

- BMEN E4420, Biomedical Signal Processing and Signal Modeling
- BMEN E6480, Computational Neural Modeling and Neuroengineering

Neurocomputational modeling and neuroengineering, pattern recognition, adaptive processing for biomedical image and signal analysis.