

Irina F. Gorodnitsky, B.S., M.S., Ph.D.

CONTACT INFORMATION

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A. MAJOR RESEARCH INTEREST: Signal Processing Theory, Neural engineering, and Neurotechnology

Robust signal processing in cluttered and noisy environments; efficient extraction of actionable information from data; nonlinear oscillator models for signal processing and for modeling biological processes; connecting non-linear theory and signal processing; robust speech processing technology; noninvasive imaging of activity of neuronal ensembles; models of sensory processing; photic brain stimulation, brain-based computer interfaces; speech-based computer interfaces; analysis and use of prosodic speech features.

B. ACADEMIC ACTIVITIES

Universities Attended

Ph.D. Doctoral study in Electrical Engineering with specialization in Signal Processing, University of California, San Diego. GPA: 4.0
Doctoral Thesis : "A Novel Class of Recursively Constrained Algorithms for Localized Energy Solutions: Theory and Application to Magnetoencephalography and Signal Processing" (Bhaskar Rao, thesis advisor). Year awarded: 1995

M.S. Graduate study in Applied Mathematics, University of Washington, Seattle, WA.
Year awarded: 1984

B.S. Undergraduate study in Mathematics and Biology, University of Washington, Seattle, WA. Year awarded: 1982

Irina Gorodnitsky

Fellowships and Honors

2006 Elevated to Senior Member of the Institute of Electrical & Electronics Engineers Society
2001 Riken Brain Science Institute Fellow
1997-98 McDonnell-Pew Postdoctoral Fellow
1991-92 Los Alamos National Laboratory Graduate Fellow
1990-91 Regents Fellow, University of California
1984 Pi Mu Epsilon (mathematics honor society)
1984 Mortar Board Scholarship

Society Membership

Senior Member Institute of Electrical & Electronics Engineers Society, member since 1991
Member Engineering in Medicine and Biology Society, since 1992
Member Signal Processing Society, since 1993
Member IEEE Women in Engineering (WIE), since 2006
Member National Defense Industrial Association (NDIA), since 2003

Professional Activities

Conference Committees

Technical Program Committee: Second International Conference on Problems in Cybernetics and Informatics (2008)

Journal Reviews

Reviewer IEEE Transactions on Aerospace and Electronic Systems
Reviewer IEEE Transactions on Signal Processing
Reviewer IEEE Transactions on Biomedical Engineering
Reviewer IEEE Signal Processing Letters
Reviewer IEEE Transactions on Image Processing
Reviewer Applied Signal Processing Journal
Reviewer NeuroImage
Reviewer Journal of Neural Engineering
Reviewer Annals of Biomedical Engineering Journal

Book Reviewer Springer US Publisher, New York

Grant Reviews

Panelist NSF Division of Information and Intelligent Systems (IIS) (2003 – 2006)

Invited Workshops

Transdisciplinary Science & Technology Workshop for Chem-Bio Defense, Sponsored by the Defense Threat Reduction Agency (DTRA) (2008).
DARPA Neurotechnology Workshop (2006).
Functional Brain Imaging, A Full-day Tutorial, ASSC Conference (1997).

Invited Seminars

- 2001 “Algebraic framework for exploiting spectral and higher-order statistics in blind source separation”, Riken, Japan
- 2000 “ Theoretical Limits of MEG-based Tomography”, NIH Center for Bioelectric Field Modeling, Simulation, and Visualization, University of Utah
- 1995 “Sparse signal representation: theory and algorithms”, Electrical Engineering Dept., UC Berkley, CA

Research Grants and Experience

Funded:

- 2008-2010** CRDF, co- Principle Investigator, A Novel Spectral Framework for Signal-Noise Separation, Department of Cognitive Science, UCSD.
- 2007-2008** Airforce Research Labs, Principle Investigator, Neural Correlates of Behavior, Department of Cognitive Science, UCSD.
- 2006-2007** Marine Corps (through Physical Optics Corp.), Principle Investigator, Impact of Intermittent Light on Normal Brain Function, Department of Cognitive Science, UCSD.
- 2004 - 2008** Owner, Neodynamic Engineering, San Diego, CA. Practical nonlinear methods for data processing in cluttered and noisy environments. Multiple projects.
- 2000 - 2004** NSF IIS- 0082119, Principle Investigator, ITR: Algorithms for Machine Perception based on Visual Cortex Models, Department of Cognitive Science, UCSD.
- 2001** SBIR Phase I grant, National Imaging and Mapping Agency. Principle Investigator, Neurobiologically Inspired Machine Vision Design, Information Systems Laboratories, Inc., San Diego.
- 1998 – 2000** NSF EIA-9806107, Principle Investigator, A New Algorithm for Minimizing Common Entropy Measures, Department of Cognitive Science, UCSD.
- 2000** NIH SBIR Phase II contract 2R44 EY11570-02 to Quantum Magnetics, Inc. San Diego. Subcontractor, Instrument for Pre-MRI Screening of Patients for Presence of Intraocular Foreign Bodies.
- 1998 – 1999** Developed algorithms for processing individual electro -encephalographic and ocular recordings. System for detection of eye movements from electro-ocular recordings. Department of Cognitive Science, UCSD.

- 1998 – 1999** DARPA contract to Quantum Magnetics, Inc. San Diego. Consultant, Nuclear Quadrupole Resonance instrumentation for detection of unexploded ordinances.
- 1998** Shelye, Inc. grant to Information Systems Laboratories, San Diego. Consultant, Non-invasive magnetic detection of fractures in implanted heart valves.
- 1997 – 1998** McDonnell-Pew Center for Cognitive Neuroscience, Postdoctoral Fellowship, Advanced Methods for EEG Based Analysis of Dynamical Brain Activity, Department of Cognitive Science, UCSD.
- 1995 – 1997** Postdoctoral research on methods for brain function imaging using magnetoencephalography, Department of Cognitive Science, UCSD.
- 1993** NSF CCF- 9220550, As graduate student co-wrote the proposal. Novel Constrained Least Squares Algorithms with application to MEG. Dep. Electrical Engineering, UCSD
- 1991-1992** Los Alamos Natl. Laboratory, Graduate Research Fellowship. Participated in the initial development and application of Superconducting Quantum Inference Devices (SQUIDs) to brain imaging.
- 1990 - 1995** As a doctoral student did original research on optimization using sparsity constraints – now an established area in signal processing.
Thesis: A novel class of recursively constrained algorithms for localized energy solutions: theory and application to magnetoencephalography and signal processing. Department of Electrical Engineering, UCSD
- 1984 – 1986** Project lead on research related to navigation and ring laser gyro instruments at Honeywell Systems and Research Center, Minneapolis.
- 1979 - 1981** Undergraduate research project. Statistical analysis of longitudinal social data (under NIH funded study on health and cultural trends of second generation Japanese Americans (Nisei)). Research advisor: Dr. Dona Leonetti, University of Washington, Seattle, WA.
- Pending:***
- 2009-2010** NIH, co- Principle Investigator, Emergency Communication System (ECO), Joint with Physical Optic Corporation.
- 2009-2011** UC Lab Research Program, Principle Investigator, A New Binary Based Analysis Framework for Correlated Signals. Department of Cognitive Science, UCSD.

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Students Mentored

Postdoctoral Fellow

- Claudia S. Lainscsek, Ph.D. Postdoctoral Fellow (Cog. Sci.). (2000 – 2004)

Graduate Students

- Anton Yen, Doctoral Candidate (Elec. Eng.), (2004 –current)
- John Hershey, Ph.D. (Cog. Sci.). Year granted: 2004.
- Carrie Joyce, Ph.D. (Cog. Sci.). Year Ph.D. granted: 2000.
- Amir Sarajedini, Ph.D. (Elec. Eng.). Year Ph.D. granted: 1999.
- Espartaco Hidalgo, M.S. (Elec. Eng.). Year granted: 1995.

Undergraduate Students

- Eva Moreno (2001-2002)
- Dmitry Beransky (1998 –2000)
- Dan Cummings (1999 – 2001)

University Service

- Chancellor's Committee on the Status of Women (1996)
- Presenter for the UCSD Howard Hughes Undergraduate Enrichment Program (2001-2002)

C. Employment Record

1999 – current Assistant Research Scientist, Department of Cognitive Sciences, University of California, San Diego

1997 – 1998 McDonnell-Pew Foundation Research Fellow, Department of Cognitive Sciences, University of California, San Diego

1995 – 1997 Postdoctoral Researcher, Department of Cognitive Sciences, University of California, San Diego

1992 – 1995 Research Assistant, Department of Electrical and Computer Engineering, University of California, San Diego

1991 – 1992 Graduate Fellow, Los Alamos National Laboratory

1989 – 1990 University of California Regents Fellow, University of California

1987 – 1989 Freelance Researcher, Vitoria, Spain

1984 – 1986 Senior Scientist, Honeywell Research Center, Minneapolis, MN

1982 – 1984 Founder, President, IFG Consulting, Inc., Seattle, Washington

Consulting

2004 – present Neodynamic Engineering, San Diego, CA. Multiple projects on employment of nonlinear methods for signal processing.

2000 NIH SBIR Phase II contract 2R44 EY11570-02 to Quantum Magnetics, Inc. San Diego. Instrument for Pre-MRI Screening of Patients for Presence of Intraocular Foreign Bodies.

1998-1999 Quantum Magnetics, Inc. San Diego.

- Nuclear Quadrupole Resonance instrumentation for detection of unexploded ordinances. (DARPA)
- 1998** Information Systems Laboratories Inc., San Diego, CA. Non-invasive magnetic detection of fractures in implanted heart valves. (Shelye, Inc.).

D. Publications

Written Work

- I. Gorodnitsky. **A nonlinear oscillator with physically meaningful parameters for robust pitch detection in noise.** *Accepted to J. Acoust. Soc. Am.*, to appear in (2009).
- I. Gorodnitsky. **Pitch modulation in affective speech by non-emotive factors: a case study.** *Int. Journal of Human-Computer Studies*, In Review. Expected publication: (2009)
- A. Yen and I. Gorodnitsky. **Investigation of a novel class of compact oscillator models for speech.** *Speech Communication*, In Review. Expected publication date: (2009)
- I. Gorodnitsky. **Evaluation of derivative time-delay modeling for robust pitch detection in very high and nonstationary noise.** Intern. Conf. on Problems in Cybernetics and Informatics (2008).
- I. Gorodnitsky, T.A. Alizada, S. Guliyeva, D. Mastaliyeva, U. Rzayeva. **A Fourier-based method for signal estimation in linearly-correlated noise.** Int. Conf. on Problems in Cybernetics and Informatics (2008).
- I. Gorodnitsky. **A Review of neural mechanisms affected by photic stimulation.** ARFL White paper. (2008)
- I. Gorodnitsky. **Dynamical theory formalism for robust modeling of damped, undamped, and nonlinear oscillatory signals.** *IEEE Acoustics, Speech and Sig Proc.* III:725-28. (2007)
- I. Gorodnitsky. **Impact of Intermittent Light on Normal Brain Function.** Report. *University of California*, San Diego, CA. (2006).
- Joyce CA, IF Gorodnitsky, and M Kutas. **Automatic removal of eye movement and blink artifacts from EEG data using blind component separation.** *Psychophysiology*, 41(2): 313-25, (2004).
- TA. Alizade and I. Gorodnitsky. **Estimation and mitigation of noise in the linearly correlated signal and noise cases.** *Application of information communication technologies in science and education*, 1:213-215. (2004).
- TA. Alizade and I. Gorodnitsky. **Effect of linearly correlated noise on signal spectrum estimation and its mitigation.** *Trans. of the Natl. Academy of Sci. Azerbaijan*, 24:26-30. (2004).
- TA. Alizade and I. Gorodnitsky. **A new spectral analysis method for signals containing quasi-normal noise.** *Proceedings International Conference on Modern Problems of Socio-Economic Development and Information Technology*. 1:178-183, ISBN 9952-8011-1-4, (2004).
- I. Gorodnitsky and C Lainscsek. **Machine Emotional Intelligence: A Novel Method for Spoken Affect Analysis.** *In Proc. Intern. Conf. on Development and Learning ICDL* , ISBN: 0-615-12704-5, (2004).
- C. Lainscsek and C. Letellier and I. Gorodnitsky. **Global Modeling of the Rössler system from the z-variable,** *Physical Letters A*, 314 (5-6) , pp. 409-427 (2003).

- C. Lainscsek and I. Gorodnitsky. **Characterization of various fluids in cylinders from dolphin sonar data in the interval domain.** *Proceedings of "Oceans 2003"*, (2003).
- C. Lainscsek and I. Gorodnitsky. **Correspondence between the Difference Equations and Differential Equations for Global Modeling**, SIAM Conf. on Applications of Dynamical Systems (DS03), (2003).
- C. Joyce, I. Gorodnitsky, J.W. King, M. Kutas, **Tracking Eye Fixation with Electroocular and Electro-encephalographic Recordings**, *Psychophysiology*, 39(5): 607-18, (2002).
- C. Joyce, I. Gorodnitsky, W.A. Teder-Salejarvi, J.W. King, M. Kutas, **Variability in AC Amplifier Distortions: Estimation and Correction**, *Psychophysiology*, 39(5): 633-40, (2002).
- I. Gorodnitsky and A. Belouchrani, **Joint Spatio-Temporal Signal Separation Algorithm for Eye Movement Detection**, *3-rd Int. Conf. on Independent Component Analysis and Signal Separation*, 1:475-80, (2001).
- I. Gorodnitsky and J.Hershey. **A Low-level Perception Model Based on Structure Finding Algorithms with Applications to Image Analysis**, *IEEE Int. Conf on Image Processing*, (2000).
- I. Gorodnitsky. **An extension of an interior-point method for entropy minimization.** *IEEE Acoustics, Speech and Signal Processing*, III: 1697-700, (1999).
- S. Tantom, Collins L, Carin L, Gorodnitsky I, Hibbs A, Walsh D, Barrall G, Gregory D and R Matthews. **Signal processing for NQR discrimination of buried land mines.** *Proc SPIE -Int Soc. Optical Eng*, 3710(1-2):474-82, (1999).
- I. Gorodnitsky. **Can compact generators of EEG/MEG fields be identified uniquely?** In: *Advances in Biomagnetism Research*, G Aine, Y Okada, G Stroink, S Swithenby and C Wood (Editors), New York: Springer-Verlag, (1998).
- I. Gorodnitsky and BD Rao. **Sparse signal reconstruction from limited data using FOCUSS: a recursive weighted norm minimization algorithm.** *IEEE Transactions on Signal Processing*, 45(3):600-616, (1997).
- I. Gorodnitsky and D. Beransky. **Fast algorithms for biomedical tomography problems.** *Proc. 30th Asilomar Conference on Signals, Systems and Computers*, (1996).
- BD. Rao and I. Gorodnitsky. **Affine scaling transformation based methods for computing low complexity sparse solutions.** *IEEE International Conference on Acoustic, Speech and Signal Processing*, 3:1783-1786, (1996).
- I. Gorodnitsky, JS. George and BD. Rao. **Neuromagnetic source imaging with FOCUSS: a recursive weighted minimum norm algorithm.** *Journal of Electroencephalography and Clinical Neurophysiology*, 95(4):231-251, (1995).
- I. Gorodnitsky and BD. Rao. **Analysis of regularization error in Tikhonov regularization and truncated singular value decomposition methods.** *Proc. 28th Asilomar Conference on Signals, Systems and Computers*, V. 1, (1994).
- I. Gorodnitsky and BD. Rao. **Truncated total least squares regularization algorithm for underdetermined problems.** *Proceedings 7th SP Workshop on Statistical Signal and Array Processing*. pp 19-22, (1994).
- I. Gorodnitsky and BD. Rao. **A recursive weighted minimum norm algorithm: analysis and applications.** *Proceedings International Conference on Acoustic, Speech and Signal Processing*. III:456-459, (1993).
- I. Gorodnitsky and BD. Rao. **Convergence analysis of a class of adaptive weighted norm extrapolation algorithms.** *Proceedings 27th Asilomar Conference on Signals, Systems and Computers*, I:339-343, (1993).

- BD. Rao and I. Gorodnitsky. **A novel recurrent network for signal processing.** *Proc. of the 1993 IEEE Workshop: Neural Net for Signal Processing*, pp 108-117, (1993).
- I. Gorodnitsky, BD. Rao and JS. George. **Source localization in magnetoencephalography using an iterative weighted minimum norm algorithm.** *Proc. 26th Asilomar Conf. on Signals, Systems and Computers*, 1:167-171, (1992).
- I. Gorodnitsky and BD. Rao. **A new iterative weighted norm minimization algorithm and its applications.** *Sixth SP Workshop on Statistical Signal and Array Processing*, (1992).
- Gorodnitsky IF, George JS, Schlitt HA and PS Lewis. **A weighted iterative algorithm for neuromagnetic imaging.** *Proc. IEEE Symposium on Neuroscience and Technology*, France, pp 60-64, (1992).
- Gorodnitsky IF. **Analysis of quantization error in ring laser gyros.** Report. *Honeywell Systems and Research Center*, Minneapolis, MN. (1986).

Presentations

- C. Lainscsek and I. Gorodnitsky. Affect Classification from Speech using Nonlinear Delay Differential Equations. *8th Experimental Chaos Conference*. (2004).
- C. Lainscsek and I. Gorodnitsky. Representation selection in global modeling: a possible task? *Dynamics Days Arizona*. Scottsdale, AZ (2003).
- C. Lainscsek and I. Gorodnitsky. Planck's Natural Units are Contained in a Time Series. *Experimental Chaos Conference*. San Diego, CA, August, (2002).
- C. Lainscsek and IF Gorodnitsky. What information of a dynamical system can be extracted from a scalar time-series?. *Dynamics Days*. Heidelberg, Germany (2002).
- C. Lainscsek and IF Gorodnitsky. Ansatz Libraries for systems with quadratic and cubic nonlinearities. *Inter. Conference on Chaos and Nonlinear Dynamics*. (2002).
- C. Lainscsek, Gorodnitsky IF and C Letellier. 3D Jerk Model from the z-variable of the Rossler System. *6th Experimental Chaos Conference*. Potsdam, Germany (2001).
- Gorodnitsky and C. Lainscsek. Modeling non-linear dynamical structure in low-dimensional EEG data. *8th Symposium on Neural Computation*. (2001).
- C. Joyce, I. Gorodnitsky, King JW and M Kutas. Tracking eye fixations using electro-ocular and electroencephalographic recordings. *8th Symposium on Neural Computation*. (2001).
- C. Lainscsek, Gorodnitsky IF and C Letellier. Reconstructing dynamics from amplitude measures of spiky time-series. *8th Joint Symposium on Neural Computation*. (2001).
- JW. King, Reber P, Gorodnitsky IF and M Kutas. Statistical wavelet analysis techniques for fMRI. *Society for Neurosci Annual Meeting*. 24(1):1178, 1998.
- Gorodnitsky. Optimality in probabilistic component analysis. *9th Annual McDonnell-Pew Center for Cognitive Neuroscience Retreat*. 1998.
- Gorodnitsky, King JW and A Sarajedini. Optimality in blind separation. *5th Annual Joint Symposium on Neural Computation*. 1998.
- JW. King, I. Gorodnitsky and M Kutas. Event-related wavelet filters: better than average, just as expected. *Journal of Cognitive Neuroscience (Supplement)*. 1998.
- Gorodnitsky IF. Advanced methods for EEG based analysis of dynamical brain activity. *8th Annual McDonnell-Pew Center for Cognitive Neuroscience Retreat*. 1997.
- Gorodnitsky IF, George JS and PS Lewis. Weighted linear estimator procedures for neuromagnetic source reconstruction. *Journal of Neuroimaging (abstract)*. *15th American Society of Neuroimaging Annual Meeting*. Vol 2:54, 1992.
- Gorodnitsky IF, George JS, Schlitt A and PS Lewis. Weighted linear estimator procedures for neuromagnetic source reconstruction. *Soc. Neurosciences Annual Meeting*. (1992).

Tracking eye fixations with electroocular and electroencephalographic recordings. Carrie a. joyce, irina f. gorodnitsky, jonathan w. king, marta kutas. Journal: Psychophysiology / Volume 39 / Issue 5 / September 2002. Published online by Cambridge University Press: 20 August 2002, pp. 607-618. Print publication: September 2002. Article. Get access. Check if you have access via personal or institutional login. Irina Gorodnitsky Irina F. Gorodnitsky, B.S., M.S., Ph.D. CONTACT INFORMATION Office Address Department of Cognitive Science MS 0515 University of California, San Diego 9500.Â Universit ies Attended. Ph.D. Doctoral study in Electrical Engineering with specialization in Signal Processing, University of California, San Diego. GPA: 4.0. Doctoral Thesis : A Novel Class of Recursively Constrained Algorithms for Localized Energy Solutions: Theory and Application to Magnetoencephalography and Signal Processing (Bhaskar Rao, thesis advisor). Founder of Cavitation Technologies, Inc., Igor Gorodnitsky is President, CEO, Secretary & Director at this company. Mr. Gorodnitsky previously occupied the position of President at Express...Â Mr. Gorodnitsky previously occupied the position of President at Express Environmental Corp. and President for Bioenergy, Inc. Current positions of Igor Gorodnitsky. Name. Title.