

RAJESH P. N. RAO

Curriculum Vitae

October 2019

Work Address:

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POSITIONS

CJ and Elizabeth Hwang Endowed Professor of Computer Science & Engineering and Electrical & Computer Engineering, University of Washington (UW), 2017-present.

Director & Co-Director, Center for Sensorimotor Neural Engineering & Center for Neurotechnology, 2013-present.

Professor, Department of Computer Science and Engineering, University of Washington (UW), 2014-2017.

Adjunct Professor, Department of Bioengineering, UW, 2009-present.

Adjunct Professor, Department of Electrical & Computer Engineering, UW, 2009-present.

Faculty Member, Neuroscience Program, UW, 2001-present.

Associate Professor, Department of Computer Science and Engineering, University of Washington (UW), 2007-2014.

Adjunct Associate Professor, Department of Bioengineering, UW, 2009-present.

Adjunct Associate Professor, Department of Electrical Engineering, UW, 2009-present.

Assistant Professor, Department of Computer Science and Engineering, UW, 2000-2006.

Research Associate, Sloan Center for Theoretical Neurobiology, Salk Institute, 1997-2000.

EDUCATION

Postdoctoral training in Computational Neuroscience, Sloan Center for Theoretical Neurobiology, Salk Institute, 1997-2000.

Ph.D. in Computer Science, University of Rochester, 1998. Dissertation title: *Dynamic Appearance-Based Vision*. Thesis Advisor: Dr. Dana Ballard.

M.S. in Computer Science, University of Rochester, 1994.

B.S. *summa cum laude* in Computer Science, Angelo State University, Texas, 1992.

B.S. *summa cum laude* in Mathematics, Angelo State University, Texas, 1992.

AWARDS AND HONORS

Guggenheim Fellow, 2016.

Fulbright Scholar, 2014.

Distinguished Speaker, Columbia University, 2012.

Invited Speaker, TED main conference, 2011.

ONR Young Investigator Award, 2003.

David and Lucile Packard Fellowship, 2002.

NSF CAREER Award, 2002.

Alfred P. Sloan Research Fellowship, 2001.

Alfred P. Sloan Postdoctoral Fellowship, Salk Institute for Biological Studies, 1997.

Presidential Fellowship for Graduate Studies, State University of New York, Buffalo, 1992 (declined in favor of Univ. of Rochester Graduate Assistantship).

Robert and Nona Carr Academic Scholarship for undergraduate study, Angelo State University, 1988-1992.

Invited participant, Research Science Institute (RSI) program for high school students, Center for Excellence in Education, Virginia, 1987.

Second rank in Science in nationwide high school examination in India (1986).

GRANTS

NSF Engineering Research Center for Sensorimotor Neural Engineering (Lead PI). NSF, 6/15/2011-7/31/2021.

Social Intelligence in Humans versus Machines: A New Framework for Understanding Imitation, Intent, and Theory of Mind. Templeton World Charity Foundation (TWCF), 9/01/18- 8/31/21.

CRCNS: Innovative Approaches to Science & Engineering Research on Brain Function: Probabilistic Models of Human Decision Making: A Computational Foundation

for Social Neuroscience (Lead PI). NIMH, 06/01/2016-05/31/2020.

Towards deep brain monitoring with superficial EEG sensors plus neuromodulatory focused ultrasound (Co-PI). NIMH, 9/1/2016-8/31/2018.

Advancing Human Brain to Brain Communication Capabilities (Co-PI). Keck Foundation, 7/1/2014-6/30/2019.

Multimodal neural decoding: Data-intensive approaches to understanding long-term, unlabeled human brain data (Co-PI). DARPA, 09/01/2017- 08/31/2020.

NCS-FO: Understanding neural processing in long-term, naturalistic human brain recordings using data-intensive approaches (Co-PI). NSF, 9/1/2016- 8/31/2019.

SL-CN: Development of Neural Body Maps (Co-PI). NSF, 9/1/2015-8/31/2018.

Goal-Based Imitation Learning (Lead PI). Office of Naval Research (ONR), 6/27/13-9/30/17.

RI: Small: Probabilistic Goal-Based Imitation Learning (Lead PI). NSF Robust Intelligence program, 8/1/13-7/31/17. Co-PIs: Dieter Fox (UW CSE), Andrew Meltzoff (UW ILABS).

Simultaneous BMI and Manual Control in Able-Bodied Subjects (Lead PI). ARO Life Sciences Division, 9/1/11-6/30/13.

Information Coding and Learning in Brain-to-Brain Communication (Lead PI). Royalty Research Fund (UW), 7/16/2012-7/15/2013. Co-PI: Chet Moritz (UW Rehab).

Decision Making and Action Selection in the Vertebrate Brain: Models and Applications in Brain-Computer Interfacing (Lead PI). NSF ERC for Sensorimotor Neural Engineering (UW), 09/15/2011-09/14/2013. Co-PIs: Michael Shadlen (UW PBIO), Chet Moritz (UW Rehab).

CRCNS: Hybrid Non-invasive Brain-Machine Interfaces for 3D Object Manipulation (Senior Personnel). NIH R01 grant, 6/1/10-5/31/14. PI: Emo Todorov (UW CSE).

IBIC: Integrated Brain Imaging Center for the University of Washington (Senior Personnel). NIH RC4 grant, 9/30/10-8/31/13. PI: Thomas Grabowski.

Electrocorticography Signals for Human Hand Prosthetics (Senior Personnel). NIH R01 grant, 5/1/10-4/30/15. PI: Jeff Ojemann (UW Neurosurgery).

Electrocorticographic Brain-Machine Interfaces for Communication and Prosthetic Control (Lead PI), NSF Biomedical Engineering Program, 09/01/2009-08/31/2012. Co-PIs: Jeff Ojemann, Yoky Matsuoka.

Probabilistic Models of Imitation and Social Cognition (Lead PI). Office of Naval Research (ONR), 3/15/09-3/14/12. Co-PI: A. Meltzoff.

Analysis of the 4500-year-old Indus script using data mining and machine learning. UW Simpson Center for the Humanities, College of Engineering, and College of Arts and Sciences, Spring 2009.

Exploring the Neural Dynamics of Cognition through Human Electroencephalography (Lead PI). NSF Cognitive Neuroscience Program, 4/15/07-3/31/10. Co-PI: J. Ojemann.

Microsoft Research Grant (Lead PI), 2/28/07-12/30/19. Co-PIs: J. Ojemann and Y. Matsuoka.

Intel Robotics Research Gift (PI), 12/22/06-12/31/19.

Probabilistic Neural Computation: Models and Applications in Robotics and Brain-Machine Interfaces (PI). NSF Emerging Models and Technologies, 9/1/06-8/31/10.

Neurally-Inspired Architectures for Invariant Object Recognition (Lead PI). NGA Neuroscience Enabled Geospatial Intelligence Program, 10/15/04-2/28/09.

Probabilistic Imitation Learning in Infants and Robots (PI). NSF Artificial Intelligence and Cognitive Science program, 08/01/04. Duration: 3 years.

Automatic Tactilization of Graphical Images: Full Access to Math, Science, and Engineering for Blind Students (Co-PI). NSF Universal Access program, 08/15/04. Lead PI: R. Ladner (UW CSE). Co-PIs: M. Ivory-Ndiaye, S. Burgstahler. Duration: 3 years.

Probabilistic Neuromorphic Systems (PI). ONR Young Investigator Program, 05/01/03. Duration: 3 years.

Probabilistic Brain-Computer Interfaces (PI). David and Lucile Packard Fellowship, 11/01/02. Duration: 5 years.

CAREER: Neurally Inspired Active Vision: Theory, Models, and Applications in Mobile Robotics (PI). NSF Robotics and Human Augmentation program, 02/15/02. Duration: 5 years.

Adaptive Neurally-Inspired Computing: Theory, Models, and Silicon-Based Architectures (Lead PI). NSF Biological Information Technology and Systems (BITS) program, 12/15/01. Duration: 5 years. Co-PI: C. Diorio (UW CSE).

Sloan Research Fellowship (PI). Duration: 2001-2003.

TEACHING

Undergraduate course on Neural Engineering (CSE 490N/BIOEN 498/BIOEN599),

UW, Winter 2018, 2017, 2016, 2015. Syllabus, slides, and course information:
canvas.uw.edu/courses/1218742

Graduate course on Computational Neuroscience (Computational Neuroscience: CSE 528/NEUBEH 528), UW, Winter 2017, Spring 2013, 2011, 2009, and 2007. Textbook: Theoretical Neuroscience by Peter Dayan and Larry Abbott. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/528/17wi/

First “massively open online course” (MOOC) on Computational Neuroscience (with Adrienne Fairhall), Coursera, Spring 2013, also offered Winter 2014, Spring 2015. Currently running monthly. Syllabus, lecture videos, slides, and course information:
www.coursera.org/course/compneuro

Undergraduate course on Artificial Intelligence (Introduction to Artificial Intelligence: CSE 473), UW, Autumn 2013, 2012 and 2006. Textbook: Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/473/13au/

Graduate course on Brain-Computer Interfaces (CSE 599E), UW, Spring 2012 and 2006. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/599e/12sp/

Undergraduate Robotics Capstone course (CSE 481C) on Imitation Learning in a Humanoid Robot, UW, Autumn 2011. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/481c/11au/

Undergraduate course on Foundations of Computing I (CSE 311), UW, Winter 2011. Textbook: Discrete Mathematics and Its Applications (sixth edition) by Kenneth Rosen. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/311/11wi/

Undergraduate course on Theory of Computation (Introduction to Formal Models in Computer Science: CSE 322), UW, Spring 2010, Winter 2006, Autumn 2004, Spring 2004, Autumn 2002, and Autumn 2001. Textbook: Introduction to the Theory of Computation by Michael Sipser. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/322/04sp/

Professional Masters Program course on Applications of Artificial Intelligence (CSEP 573), UW, Winter 2010. Textbook: Artificial Intelligence: A Modern Approach (3rd ed.) by Stuart Russell and Peter Norvig. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/csep573/10wi/

Special one-week graduate seminar (HUM 597A) on “Deciphering the Indus script: Past efforts and recent approaches” sponsored by the UW Simpson Center for the

Humanities, Spring 2009.

Undergraduate course on Computer Vision (Computer Vision: CSE 455), UW, Winter 2009. Textbook: Computer Vision by Shapiro and Stockman, Prentice-Hall, 2001. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/455/09wi/

Graduate course on Computational Neuroscience (Introduction to Computational Neuroscience: CSE 590RR), UW, Autumn 2003 and Spring 2002. Textbook: Theoretical Neuroscience by Peter Dayan and Larry Abbott. Syllabus, slides, and course information: www.cs.washington.edu/education/courses/590rr/03au/

Undergraduate course on Data Structures and Algorithm Analysis (CSE 326), UW, Winter 2003. Textbook: Data Structures and Algorithm Analysis in Java/C++ by Mark Weiss. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/326/03wi/

Graduate seminar on Neural Computation (CSE 590NC), UW, Autumn, Winter and Spring 2001-2003. Course information:
www.cs.washington.edu/education/courses/590nc/

Undergraduate and graduate independent study (CSE 498, MATH 498, and CSE 600), 2001-present.

Undergraduate course on Data Structures and Algorithm Analysis (CSE 373), UW, Spring 2001. Textbook: Data Structures and Algorithm Analysis in C by Mark Weiss. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/373/01sp/

Professional Masters Program course on Alternative Computing Paradigms (CSE 599), UW, Winter 2001. Textbook: Feynman Lectures on Computation by Richard Feynman. Syllabus, slides, and course information:
www.cs.washington.edu/education/courses/599/01wi/

Delivered lectures for an undergraduate course on Computational Neurobiology (BIPN 146) at University of California, San Diego, 1999. Professor: T. Sejnowski. Textbook: Biophysics of Computation by Christof Koch.

Teaching Assistant, Department of Computer Science, University of Rochester, Spring 1993 and 1994. Courses: 1. Theory of Computation 2. Design and Analysis of Algorithms.

Teaching Assistant, Mathematics Department, Angelo State University, 1989-1992. Undergraduate courses on calculus and analytical geometry.

Teaching Assistant, Physics Department, Angelo State University, 1989-1990. Under-

graduate courses on fundamentals of physics.

**GRADUATE
MENTORING
(CURRENT)**

Dimitrios Gklezacos, graduate student, CSE. Research Topic: Unsupervised deep learning.

Koosha Khalvati, graduate student, CSE. Research Topic: Tracking neural activity across an entire nervous system.

Nile Wilson, graduate student, Bioengineering. Research Topic: Error signals in ECoG. Co-advisor: Jeff Ojemann.

David Caldwell, MD/PhD student. Research Topic: ECoG BCIs. Co-advisors: Jeff Ojemann.

Michael Chung, graduate student, CSE. Research Topic: Goal-Based Imitation Learning in Robots. Co-advisor: Maya Cakmak.

**GRADUATE
MENTORING
(PAST)**

Nancy Wang, graduate student, CSE. Research Topic: Automated decoding of human neural data with video and audio recordings. Co-advisor: Bing Brunton.

James Wu, graduate student, Bioengineering. Research Topic: ECoG decoding for finger movements and grips. Co-advisor: Jeff Ojemann.

Jeneva Cronin, graduate student, Bioengineering. Research Topic: ECoG stimulation for sensory feedback. Co-advisor: Jeff Ojemann.

Devapratim Sarma, graduate student, Bioengineering. Research Topic: ECoG BCIs. Co-advisor: Jeff Ojemann.

Matt Elzinga, graduate student, Neurobiology and Behavior. Research Topic: Naturalistic ECoG decoding.

Jeremiah Wander, PhD, 2016, BioE. Research Topic: Learning in ECoG BCIs. Current Employment: Microsoft Research.

Melissa Smith, PhD, 2016, Neurobiology and Behavior. Research Topic: Extracting cortical activity from non-invasive and subdermal brain recordings. Current Employment: MultiModal Health.

Yanping Huang, PhD, 2014, CSE, Howard Hughes Medical Institute (HHMI) Graduate Fellow. Research Topic: Decision Making in the Brain. Current Employment: Google.

Tim Blakely, Bioengineering, PhD, 2013. Research Topic: BCI for Prosthetic Hand Control. Current Employment: Google.

Amnon Horowitz, graduate student, CSE, 2014-16. Research Topic: Tracking neural activity across an entire nervous system. Current advisor: Dieter Fox.

Harley Montgomery, graduate student, CSE. Research Topic: Probabilistic Programming for Robotic Learning.

Jeffrey Herron, graduate student, EE, 2012-2013, PhD, 2016. Research Topic: Direct Sensory Augmentation. Current Employment: Medtronic.

Justin Bare, graduate student, CSE, 2012-2013. Research Topic: Probabilistic Models of Time Perception.

Sam Sudar, graduate student, CSE, 2012-2013. Research Topic: Electrocorticography for Hand Prosthetics.

Abe Friesen, graduate student, Computer Science and Engineering. Topic: Imitation Learning. Qualifying Exam: 2010. Current Advisor: Pedro Domingos.

Kai Miller, MD-PhD, UW. Research Topic: Electrocorticographic Brain-Computer Interfaces. Current Employment: Stanford University (resident).

Pradeep Shenoy, CSE, PhD, 2008. PhD Thesis: Brain-Computer Interfaces for Control and Computation. Current Employment: Microsoft India.

Xu Miao, CSE, PhD, 2011. Research Topic: Margin-based Probabilistic Networks for Fast and Consistent Structured Prediction. Current Employment: Microsoft (Redmond).

Deepak Verma, CSE, M.S., 2010. Research Topic: Planning as Inference. Current Employment: Google.

Erick Chastain, Neurobiology and Behavior, M.S., 2010. Research Topic: Probabilistic Models of Reward-Based Learning in the Brain. Current Employment: Rutgers University.

Aaron Shon, CSE, PhD. Graduated: Autumn 2007. PhD Thesis: A Multidisciplinary Approach to Probabilistic Imitation in Humans and Machines. Current Employment: Google/YouTube.

David Grimes, CSE, PhD. Graduated: Autumn 2007. PhD Thesis: Bayesian Models of Action and Imitation. Current Employment: Jawbone.

Rawichote Chalodhorn, visiting graduate student, Osaka University, Japan. Research Topic: Learning in Humanoid Robots (Primary Advisor: Minoru Asada).

Alex Dieudonne, Biology and UW Neurobiology and Behavior Program (Primary Ad-

visor: Tom Daniel), PhD. Graduated: Spring 2008.

Sangyun Han, graduate student, CSE. Research Topic: Automatic Tactilization of Graphics for the Blind (Primary Advisor: Richard Ladner).

Pat Tressel, graduate student, CSE. Research Topic: Computational Neuroscience.

Tim Hanks, Brian Lundstrom, and Jeff Longnion, graduate students (in lab rotation), UW Neurobiology and Behavior Program and UW Medical Scientist Training Program.

**UNDERGRAD
MENTORING**

Preston Jiang, CSE, 2018 CRA Award Honorable Mention. Research Topic: BrainNet: Multi-person brain-to-brain collaboration.

Darby Losey, CSE and Neuroscience, 2016 CRA Award Honorable Mention. Research Topic: Brain-to-brain communication and brain stimulation.

Hayoun Oh, CSE. Research Topic: Passive EEG BCIs.

Thomas Crosley, CSE. Research Topic: Deep learning for Vision.

Priya Rao Chagaleti, CSE. Research Topic: BCI for Rehabilitation.

Maxwell Forbes, CSE. Research Topic: Natural Language-based Interaction for Humanoid Robots.

Matt Elzinga. Research Topic: Brain-to-Brain Communication.

Matthew Bryan, CSE, 2012 CRA Award Finalist and Mary Gates Scholar. Research Topic: Co-Adaptive BCI and Brain-to-Brain Communication.

Stefan Martin, EE. Research Topic: Probabilistic BCI.

Lucas Petrucci, CSE/Neurobio. Research Topic: Machine Learning for BCI and Motor Control.

Alex Dadgar and Joseph Wu, CSE. Research Topic: BCI for Brain-to-Brain and Robotic Control.

Chantal Murthy, CSE. Research Topic: BCI for Rehabilitation.

Michael Chung, CSE. Research Topic: Brain-computer interfacing for robotic control. Subsequent affiliation: Ph.D. program, UW CSE.

Willy Cheung, CSE. Research Topic: Brain-computer interfacing for robotic control. Subsequent affiliation: Ph.D. program at Max Planck Institute, Germany.

Anibel America, BioE. Research Topic: Brain-Computer Interfaces.

Gabriel Maganis and Danny Rashid, undergraduate students, CSE. Research Topic: Humanoid Robotics. Subsequent affiliations: Graduate programs at UC Santa Barbara and CMU.

Alex Zheng and Chris Gonterman, undergraduate students, CSE. Research Topic: Connecting Diets to Disease Using Data-Mining to Find Links between Food Consumption and Chronic Diseases.

Yanni Wu, undergraduate student and Boeing Scholar, CSE. Research Topic: Vision for Humanoid Robotics.

Shen-Hui Lee, Nathan Evans, Ian Ma, Isaac Myers, and Christian Bell, undergraduate students, CSE. Research Topic: Brain-Computer Interfaces.

Matt Hoffman, undergraduate student and Mary Gates scholar, CSE. Research Topic: Gaze Following by a Robotic Head. Subsequent affiliation: PhD student at UBC.

Chris Baker, undergraduate student and Mary Gates scholar, Early Identification Program, CSE, 2002-2004. Research Topic: Neural Computation with Dynamic Synapses. Subsequent affiliation: PhD student at MIT.

Beau Crawford, undergraduate student, CSE. Honorable mention in the nation-wide CRA Outstanding Undergraduate Student competition, 2003-2005. Research Topic: Brain-Computer Interfaces. Subsequent affiliation: Microsoft.

Kohen Chia, Brian Chang, Ikroop Dhillon, Tushar Jain, Samuel Kim, Lloyd Parlee, and Ie Ming Tjam, undergraduate students, CSE, 2002-2005. Research Topic: Brain-Computer Interfaces.

Shengli Zhou, undergraduate student, CSE, 2003-2004. Research Topic: Probabilistic Color Indexing.

Yow Han, undergraduate student, CSE, 2003-2004. Research Topic: Face Detection in a Humanoid Robot.

Abhinav Jain, undergraduate student, CSE, 2003-2004. Research Topic: Face Detection. Presently a graduate student at Purdue.

Tulika Kumar, undergraduate student and Mary Gates scholar, CSE, 2002-2003. Research Topic: Reinforcement Learning in a Robotic Head. Currently at Action Engine.

Alice Chen-Chun Lin, undergraduate student and Mary Gates scholar, CSE, 2003. Research Topic: Visual Learning in a Robotic Head.

Marshella Tjandra, undergraduate student, Applied and Computational Mathematical Sciences, UW, 2002. Research Topic: Vision and Learning.

Thomas Carlson, Mary Gates Scholar, CSE, 2002. Research Topic: Imitation Learning.

DEPARTMENT SERVICE

CSE Professional Masters Program Committee, 2018-19, 2009-2010.

CSE College Council Representative, 2012-2018.

CSE Department Diversity Committee, 2001-2004, 2015-present. Participated in the formulation of a new plan for enhancing recruitment and retention of women and minorities in the CSE department.

CSE Direct Admits Seminar, 2013-2014.

CSE Recruiting Committee, 2011-2012.

CSE Broadening Participation Committee, 2009-2010.

Represented department at NCWIT Pacesetters Planning meeting focusing on increasing women's participation in computing, May 2009.

K-12 Outreach: Thirty 6th and 7th grade students from Vista Academy (Bellevue, WA) visited the Brain-Computer Interfaces and Humanoid Robotics Labs for live demonstrations (Wednesday, Jan 21, 2009).

CSE Executive Committee, 2006-2007.

CSE Space Management Committee, 2004-present (with Prof. Paul Beame, Erik Lundberg, Tracy Bartholomew, Chris Cunningham).

CSE Course Scheduling Committee, 2004 (with Prof. Richard Anderson).

Committee Member: Generals committee for CSE students Seth Bridges, Miguel Figueroa, David Hsu, Amol Prakash, Kambiz Rahimi, Zasha Weinberg, and Ken Yasuhara. Final exam committee for CSE students Jia-chi Wu, Nan Li, Ke Zheng, Zasha Weinberg, David Hsu, and Yung-Yu Chuang. Qualls committee for CSE student Robert Gens.

DEPARTMENTAL COLLABORATIONS

(Past) Maya Cakmak: Collaboration on Goal-Based Imitation Learning in Robots. Co-Advisee: CSE graduate student Michael Chung. <https://www.overleaf.com/project/5d9d4d06a51343000104>
(Past) Emo Todorov: Collaboration on Brain-Computer Interfaces for Robotic Prostheses.

(Past) Shyam Gollakota: Collaboration on Nonintrusive Tongue-Machine Interface.

Co-Advisee: Qiao Zhang.

(Past) Luke Zettlemoyer: Collaboration on Human-Robot Interaction using Speech.
Co-Advisee: CSE undergrad Maxwell Forbes.

(Past) Richard Ladner: Collaboration on the Tactile Graphics Project; Joshua Smith:
Collaboration on Brain-Robot Interfacing.

UNIVERSITY SERVICE

Direct Admissions to College Proposal Committee, College of Engineering, 2014-15.

Public outreach lectures for College of Engineering, Psychology department, Neuro-
science program, and others, 2000-present.

Pacific Science Center, Exhibit on Brain-Computer Interfaces, 2013.

University Diversity Council, 2012-2014.

Committee Member: Neurobiology and Behavior Development Committee, Septem-
ber 2008-2010.

Faculty Field Tour, 2002. Participated in a five-day faculty bus tour around the state
of Washington with President Richard L. McCormick to further relations of UW with
the residents of Washington state.

Mentor, UW Early Identification Program (EIP), 2002. Goal: To encourage and assist
UW undergraduate students from underrepresented, educationally, and economically
disadvantaged groups to enter graduate school. Advisees: Chris Baker and Ie Ming
Tjam.

Graduate School Representative (GSR), 2001-present: Niranjan Balu, Lara Touryan
and Kristopher Kubow, UW Bioengineering department.

Thesis Committee Member, 2004-present: Stavros Zanos, Physiology and Biophysics;
Alex Dieudonne, Zoology Department; Rachel Yotter, Electrical Engineering.

Lab Rotation Advisor, 2001-present: Kira Shin-ichiro, Yanping Huang, Erick Chas-
tain, Kai Miller, Alex Dieudonne, Tim Hanks, Brian Lundstrom, and Jeff Longnion,
UW Neurobiology and Behavior Program and UW Medical Scientist Training Pro-
gram.

CROSS- CAMPUS PARTNERSHIPS

Collaborative research on *Brain-to-Brain Interfacing and Augmentation* with Andrea
Stocco (Assistant Professor, UW Psychology and Institute for Learning and Brain Sci-
ences) and Chantel Prat (Associate Professor, UW Psychology and Institute for Learn-
ing and Brain Sciences), 2011-present.

Collaborative research on *Social Intelligence and Imitation Learning in Infants and*

Machines with Andrew Meltzoff (co-director, UW Institute for Learning and Brain Sciences), 2002-present.

Collaborative research on *Brain-Computer Interfaces using ECoG and Intracortical Activity* with Jeff Ojemann (neurosurgeon, UW Medical Center and Harborview Hospital) and Eb Fetz (UW Department of Physiology and Biophysics), 2004-present.

(Past) Collaborative research on *Brain-Computer Interfacing and Augmentation* with Chet Moritz (Assistant Professor, UW Department of Rehabilitation Medicine), 2012-present.

(Past) Collaborative research on *Tactilization of Graphics for the Blind* with Richard Ladner (CSE), Melody Ivory-Ndiaye (UW Information School), and Sheryl Burgstahler (director, UW DO-IT program), 2002-2005.

PROFESSIONAL ACTIVITIES *Editorial Board:* Neural Networks Journal, 2012-15; Cognitive Science Journal, 2007-2015. Machine Learning Journal and Autonomous Robots Journal (Joint Special Issue on Learning in Autonomous Robots); Neural Computation (Communicating Reviewer).

Advisory Board: Bernstein Focus for Neurotechnology on Computational Vision, Frankfurt Institute for Advanced Studies, 2009-2013.

Workshop Co-Chair: Workshop on decoding long-term naturalistic recordings (Organization for Human Brain Mapping Meeting), 2017; Neural Information Processing Systems (NIPS) Workshops Co-Chair, 2006.

Program Committees: Robotics: Science and Systems (RSS), 2007; Uncertainty in AI (UAI), 2005-2006; Third International Conference on Development and Learning (ICDL), 2004; American Association for Artificial Intelligence (AAAI) annual conference, 2004; Neural Information Processing Systems (NIPS), 2003; Computer Vision and Pattern Recognition (CVPR), 2000; American Association for Artificial Intelligence (AAAI) annual conference, 1997.

Conference Session Chair: Society for Neuroscience Annual Meeting, San Diego, October 27, 2004 (chair for session on “Visual Cortex: States and Networks”); Neural Information Processing Systems (NIPS), 2003 (chair for two oral sessions on Computational Neuroscience and Neural Engineering, December 9 and 10).

Organizing Committee: Robotics: Science and Systems (RSS), 2009; Neural Information Processing Systems (NIPS), 2002.

Organizer: UW-Osaka-IIT International Symposium on Cognitive Neuroscience Robotics, Seattle, WA, January 31-February 1, 2013; 1st Winter School on Computational Aspects of Neural Engineering, Bangalore, India, December 12-19, 2012 (with G. Ranganathan); UW-Osaka Joint Symposium on Cognitive Neuroscience Robotics, Seattle,

WA, March 17-18, 2011; Okinawa Computational Neuroscience Course, November 9-19, 2004 (with K. Doya, S. Ishii, and A. Pouget); Workshop on “Statistical Theories of Cortical Function” at Breckenridge, Colorado, December 4, 1998 (with B. Olshausen and M. Lewicki).

Reviewer (Journals): Science, Nature Neuroscience, Neural Computation, Neural Networks, Network: Computation in Neural Systems, Journal of Neuroscience, Biological Cybernetics, Journal of Cognitive Neuroscience, Psychological Science, Cognitive Science, Visual Cognition, Neuropharmacology, IEEE Transactions on Robotics and Automation, IEEE Pattern Analysis and Machine Intelligence, International Journal of Computer Vision, Computer Vision and Image Understanding, Human Computer Interaction, Physical Review Letters, Information Processing Letters, Theoretical Computer Science, Videre: A Journal of Computer Vision Research.

Reviewer (Conferences): Neural Information Processing Systems (NIPS), American Association for Artificial Intelligence (AAAI), Computer Vision and Pattern Recognition (CVPR), Int. Conf. on Computer Vision (ICCV).

Reviewer (Funding Agencies): National Science Foundation (NSF) Robust Intelligence (Large) review panel, NSF Emerging Technologies (EMT) review panel, NSF CAREER award review panel, NSF postdoctoral fellowship review, NIMH grant review.

Organizations: Association for Computing Machinery (ACM), Society for Neuroscience, IEEE (current). Past: New York Academy of Sciences, ACM Special Interest Group on Algorithms and Computation Theory and ACM Special Interest Group on Artificial Intelligence.

RESEARCH INTERESTS

Computational neuroscience, brain-computer interfaces, and artificial intelligence.

PUBLICATIONS

Books

1. *Brain-Computer Interfacing: An Introduction*, Rajesh P. N. Rao, New York, NY: Cambridge University Press, 2013.
2. *Probabilistic Models of the Brain: Perception and Neural Function*, Rajesh P. N. Rao, Bruno A. Olshausen and Michael S. Lewicki (Eds.), Cambridge, MA: MIT Press, 2002.
3. *Bayesian Brain: Probabilistic Approaches to Neural Coding*, Kenji Doya, Shin Ishii, Alexandre Pouget, and Rajesh P. N. Rao (Eds.), Cambridge, MA: MIT Press, 2007.

Book Reviews

4. “Awakening a sleeping cat: A review of *Information Theory and the Brain* edited by R. Baddeley, P. Hancock, and P. Földiák,” Rajesh P. N. Rao, *Neural Networks*, Vol. 15(7), pp. 927-929, 2002.

5. "Learning to maximize rewards: A review of Sutton and Barto's *Reinforcement Learning: An Introduction*," Rajesh P. N. Rao, *Neural Networks*, Vol. 13(1), pp. 135-137, 2000.

Invited Articles

6. "Towards neural co-processors for the brain: Combining decoding and encoding in brain-computer interfaces," R. P. N. Rao, *Current Opinion in Neurobiology*, 55:142-151, 2019.
7. "When Two Brains Connect," RPN Rao and A Stocco, *Scientific American Mind* 25(6):36-39, 2014.
8. "Brain-computer interfaces: a powerful tool for scientific inquiry," J. Wander and R. P. N. Rao, *Current Opinion in Neurobiology*, 25:70-75, 2014.
9. "Predictive coding," Y. Huang and R. P. N. Rao, *Wiley Interdisciplinary Reviews: Cognitive Science*, 2(5):580-593, 2011.
10. "Probabilistic Analysis of an Ancient Undeciphered Script," R. P. N. Rao, *IEEE Computer*, 76-80, 2010.
11. "Brain-computer interfacing [in the spotlight]," RPN Rao, R Scherer, *IEEE Signal Processing Magazine*, 27(4), 2010.
12. "Statistical Pattern Recognition and Machine Learning in Brain-Computer Interfaces," Rajesh P. N. Rao and Reinhold Scherer, Karim G. Oweiss (ed.), *Statistical Signal Processing for Neuroscience and Neurotechnology*, 2010.
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PRESS COVERAGE

1. BrainNet research featured on *National Public Radio* series *Future You*, with *Elise Hu*: "How Computer-Assisted Telepathy Helps Humans Communicate," May 8, 2019.
2. Video segment on BrainNet by *National Public Radio* titled "How Computer-Assisted Telepathy Helps Humans Communicate," May 7, 2019.
3. Coverage of our Indus script research in an article titled "Why We Still Cant Read the Writing of the Ancient Indus Civilization," by Bridget Alex in *Discover Magazine*, January 4, 2019.
4. Article on BrainNet titled "Scientists Connect Three People's Minds So They Can Communicate," by Aristos Georgiou in *Newsweek*, October 3, 2018.
5. BrainNet research featured in online articles on *Voice of America*, *Psychology Today*, *MIT Technology Review*, etc. October 2 and 3, 2018.
6. Video segment by *Reuters* titled "Scientists see a mind controlled virtual reality" featuring our work on using brain stimulation to navigate a virtual world, January 27, 2017.
7. Quoted extensively in article "Cipher War: After a century of failing to crack an ancient script, linguists turn to machines" by Mallory Locklear in *The Verge*, January 25, 2017.

8. Coverage of our work on navigating virtual worlds using brain stimulation, November-December, 2016: *New Scientist*, *Daily Mail*, *Nature World News*, *New Atlas*, *CNET*, *Digital Trends*, *TechRadar*, *Tech Times*, *Futurism*, *Engineering.com*, *Express.co.uk*, *Science Daily*.
9. Coverage of our work on using ECoG brain stimulation for closed-loop somatosensory feedback, October-November, 2016: *GeekWire*, *New Atlas*, *Futurism*, *Science Daily*, *UW Today*.
10. Article in *Seattle Times* titled “Can thoughts be harnessed to move robotic limbs?” covering CSNE center’s research, October 21, 2016.
11. Quoted in *New York Times* article “Chip, Implanted in Brain, Helps Paralyzed Man Regain Control of Hand” by Benedict Carey, April 13, 2016.
12. Coverage of *PLoS Comp Bio* paper on real-time decoding of human object perception from ECoG, January, 2016: “Scientists decode brain signals nearly at speed of perception” in *GeekWire*, *Live Science*, *Economic Times*, *EurekaAlert*, *RedOrbit*, *Gizmodo*, *Engadget*.
13. Quoted extensively in article “UW brain implant could help paralyzed limbs move again” in *Seattle Times*, December 29, 2015.
14. Coverage of CSNE center’s renewal, December, 2015-January 2016: *Motherboard*, *International Business Times*, *Daily Mail*, *ScienceAlert*, *ZD Net*, *UW Today*.
15. Article “New Robots Could Learn Like Children” in *Smithsonian.com* featuring our robot learning research with Andrew Meltzoff, December 11, 2015.
16. Article “Why Robots Should Be More Like Babies” in *The Atlantic* featuring our robot learning collaboration with Andrew Meltzoff, December 7, 2015.
17. Coverage of *PLoS One* article on robots that emulate babies to learn by imitation, December 2015: *Popular Science*, *RedOrbit*, *Quartz*, *Futurity*, *Singularity Hub*, *Science Daily*.
18. Article “Can you crack the Indus code?” in *The Daily Mail* references our work on the Indus script, October 22, 2015.
19. Article “Cracking the Indus script” in *Nature* by Andrew Robinson references our work on computational analysis of the Indus script, October 20, 2015.
20. Coverage of *PLoS One* article on playing “20 questions” with brain-to-brain communication, September, 2015: *ABC News*, *Guardian*, *Seattle Times*, etc.
21. Article “Why Brain-to-Brain Communication Is No Longer Unthinkable” in *The Smithsonian Magazine* featuring our brain-to-brain interface research, May, 2015.

22. Coverage of *PLoS One* article on first human brain-to-brain interface, November, 2014: *NBC News*, *MIT Technology Review*, *CNET*, *Scientific Computing*, *The Hindu*, *International Business Times UK*, *Toronto Sun*, *Daily Mail*, *Daily Star*, *National Geographic Italia*, *Science Daily*.
23. Robots that use crowdsourcing for learning, June 2014: *Popular Science*, *Nature World News*, *Tech Times*, *KurzweilAi*, *New Atlas*, *Science 2.0*, *Phys.org*, *Digital Trends*.
24. Worldwide coverage of first human brain-to-brain interface, August-September, 2013: *New York Times*, *Washington Post*, *USA Today*, *National Public Radio*, *NBC*, *ABC*, *CBS*, *Reuters*, *CNN*, *Fox*, *Forbes*, *Huffington Post*, *BBC*, *CBC*, *Telegraph*, *Times of India*, *Indian Express*, *Korea Times*, *China Post*, *National Geographic*, *Discover*, *Scientific American*, *Science*, etc.
25. Quoted in *Scientific American* article “This brain discovery may overturn a century-old theory,” by Ben Thomas, August 8, 2013.
26. Quoted in *USA Today* and *Associated Press* article Mind-controlled robot gives paralyzed man mobility, by Frank Jordans, April 24, 2012.
27. Robotics and neuroscience research covered over several pages in the popular press book *The Two-Second Advantage: How We Succeed by Anticipating the Future – Just Enough* by Vivek Ranadiv and Kevin Maney, Crown Business Press, September, 2011.
28. Research and biography profiled in IEEE’s *The Institute* in an article titled “Rajesh Rao: Deciphering a 4000-Year-Old Script,” July, 2011.
29. Article in *MIT Technology Review*: How Babies Know What Robots Are Thinking. New research tells us something about infants’ theory of mind, as well as how to build robots humans instinctively recognize as sentient, by Christopher Mims, February 2, 2011.
30. Cover article: Meet the Growbots: Social robots take baby steps toward humanlike smarts, by Bruce Bower in *Science News* magazine, Vol.179(3) p. 18, January 29, 2011.
31. Collaborative research with developmental psychologist Andy Meltzoff covered in:
 - *Popular Science*: In New Study, Babies Think A Silvery Robot Is Human, As Long As It Acts Friendly, by Dan Nosowitz, October 14, 2010.
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 33. BBC News: "The robot that reads your mind to train itself" by Lakshmi Sandhana, 24 October 2010.
 34. CBC News: "Human-machine mergers promising, but reality yet to live up to hype" by Grant Buckler, May 25, 2010.
 35. *PNAS* paper on neural augmentation by brain-computer interfacing covered in *Science Daily*, *Daily Tech*, *Tech Radar*, *UPI Tiscali (Italian)*, *DNI (Russian)*, *Money Times*, and *Tech Eye*.
 36. Quoted in *CNN* article "The future of brain-controlled devices," January, 2010.
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 39. Featured segment on *CBS News Sunday Morning* with Bill Geist on our brain-controlled robot research, May 20, 2007.
 40. Featured segment on *ABC News: Ahead of the Curve* on our brain-controlled robot research, May, 2007.
 41. Interview for *National Public Radio (NPR)*: KPLU (Seattle) Series on "The Electric Brain". Segment focusing on our brain-computer interface for controlling a humanoid robot, January, 2007.
 42. Interview for *Seattle Times* for their Front Page article on our research: "Robot puts human thoughts into action", January, 2007.

43. Interview for *KING 5 TV* (Seattle) for their news segment on our brain-computer interface for controlling a humanoid robot, February, 2007.
44. Press articles on our brain-controlled humanoid robot research in: *The Telegraph* (London), *Times of India* (Bombay), *Discovery Channel News*, *Discover Magazine*, *Popular Mechanics*, and others, 2006-2007.
45. Quoted in a story on building neural circuits in silicon. *New York Times*, page D12, June 29, 2000.
46. “Building Computers That See, Adapt and Learn” by Rajesh P. N. Rao, Translated article (in Kannada) appeared in *Udayavani Kannada Daily* (India), July 21, 1996.
47. Quoted in a story describing our group’s mobile robot research (see above). *Rochester Democrat and Chronicle* (Daily), page 8B, December 22, 1994.
48. Brief television interviews on mobile robot research. Rochester News Channel 13 and Rochester Independent News, December 1994.

INVITED TALKS

1. *Predictive Coding Models of Brain Function: Past, Present and Future*, Keynote lecture, Sainsbury Wellcome Centre Workshop on “Predictive Processing in the Brain,” April 8, 2019.
2. *The Bayesian Brain: From Predictive Coding to Decision Making*, Center for Brain Science, Harvard University, October 16, 2018.
3. *Bayesian Models of the Neocortex: From Predictive Coding to POMDPs*, Workshop on “Why Does the Neocortex Have Layers and Columns?”, Banbury Center, October 29, 2018.
4. *Advances in the Field of Brain-Computer Interfaces*, Allen L. Edwards Public Lecture Series, University of Washington, March 29, 2017.
5. *Neurotechnologies to Help the Body Move, Heal, and Feel Again: Research at the Center for Sensorimotor Neural Engineering*, Houston Methodist Research Institute Neuroregeneration Symposium, March 16, 2017.
6. *Understanding the Brain through Probabilistic Models and Brain-Computer Interfaces*, plenary talk at QANSAS 2016, Agra, India, November 25, 2016.
7. *Brain-Computer Interfaces: Recent Advances and Future Applications*, Indian Institute of Technology, New Delhi, November 18, 2016.
8. *Building a Neuroprosthesis for Reanimating Paralyzed Limbs: Research at the NSF Center for Sensorimotor Neural Engineering*, Center for Neuroengineering, University of Minnesota, September 15, 2016.
9. *Standards needed for bidirectional braincomputer interfaces*, NIH Workshop on Standards and Modularity of Brain-Computer Interfaces and Neuroprostheses, Rockville, MD, June 30, 2016.

10. *Probabilistic Models of Brain Function: From Predictive Coding to Decision Making*, Brown University, Department of Neuroscience, April 9, 2015.
11. *Brain / Mind / Body* panel, Computing Community Consortium and BRAIN Initiative Symposium on “Research Interfaces between Brain Science and Computer Science,” Washington DC, December 4, 2014.
12. *From Brain-Computer Interfacing to Brain-to-Brain Interfacing*, TTI/Vanguard [Next] conference, San Francisco, December 10, 2013.
13. *Brain-Computer Interfaces for Human Augmentation*, Army Human Dimension Futures Meeting, Washington DC, November 4, 2013.
14. *Opportunities and Challenges for Machine Learning in Brain-Computer Interfacing*, UW-Microsoft Research Machine Learning Day, Seattle, October 18, 2013.
15. *The Bayesian Brain: From Perception to Action*, eSMCs Summer School on Embodiment and Morphological Computation, Zurich, Switzerland, September 24, 2013.
16. *Bayesian Developmental Robotics: Towards Robots that Learn from Human Interaction*, The 5th Symposium on Cognitive Neuroscience Robotics, Osaka, Japan, August 22, 2013.
17. *The Bayesian Brain: Towards a Unified Theory of Brain Function*, Howard Hughes Medical Institute - JFRC, June 17, 2013.
18. *Bayesian Models of Brain Function* (Invited Speaker), Bayes by the Bay: Workshop on Bayesian Methods in Science, Pondicherry, India, January 5-6, 2013.
19. *Controlling Objects by Thought: The Emerging Science of Brain-Computer Interfacing* (Distinguished Lecture), Columbia University, Computer Science Department, March 7, 2012.
20. *Reward Maximization in the Primate Brain: A Probabilistic Model of Decision Making under Uncertainty*, Workshop on Mechanism of Brain and Mind, Rusutsu, Japan, January 17, 2012.
21. *Probabilistic Goal-Based Imitation Learning* (Invited Speaker), ICML Workshop on New Developments in Imitation Learning, July 2, 2011.
22. *Hierarchical Brain-Computer Interfacing for Adaptive Robotic Control* (Invited Speaker), DARPA Biologically-Driven Navigation (BioNav) Workshop, May 25, 2011.
23. *A Rosetta Stone for the Indus Script* (Invited Speaker), TED 2011 (main conference), Long Beach, CA, March 4, 2011.
24. *BCI in Seattle: Understanding the ECoG Signal for Robust and High Bandwidth Control* (Invited Speaker), 39th Neural Interfaces Conference, Long Beach, CA, June 23, 2010.

25. Invited talk in the UW Computational Neuroscience Colloquium series, April 30, 2010.
26. Invited lectures in UW course *Seminar in Computational Neuroscience* (BIOL 488), 2011-12.
27. *A Neural Model of Model-Based Action Selection and Decision Making* (Invited Speaker), Workshop on Goal Directed Decision Making: Behavior, Neuroscience and Computation, Princeton University, October 23-24, 2009.
28. *Compact Course on Brain Computer Interfaces*, Indian Institute of Science, Bangalore, India, February 5-8, 2008.
29. *Brain-inspired models of Bayesian computation, with applications to humanoid robotics and brain-machine interfaces* (Plenary talk), International Conference on Neural Information Processing (ICONIP), Kitakyushu, Japan, 13-16 November, 2007.
30. *Controlling Cursors and Robots by Thought: Brain-Computer Interface Research at the University of Washington*, AIST, Japan, 19 November, 2007.
31. *Bayesian Models of Cognition, with Applications to Robotics and Brain-Machine Interfaces*, 13th International Congress on Logic Methodology and Philosophy of Science, Beijing, China, August 9-15, 2007.
32. *Creating a Bayesian Brain: Lessons from Neuroscience and Robotics*. Honda International Symposium on "Creating Brain-like Intelligence", Hohenstein, Germany, February, 2007.
33. *The Mind-Body Connection*. 2006 Engineering Lecture Series, University of Washington, October, 2006.
34. *Graphical Models for Sensorimotor Learning*. NIPS Workshop on Grounding Perception, Knowledge and Cognition in Sensori-Motor Experience, December, 2006.
35. *Action as Bayesian Inference*. Computation and Neural Systems Program, Caltech, May, 2006.
36. *Synaptic Plasticity and Probabilistic Inference in Neuronal Networks*. Gordon Research Conference on Theoretical Biology and Biomathematics, Tilton, NH, June, 2006.
37. *Action as Bayesian Inference*. Workshop on Bayesian Cognition, Paris, January, 2006.
38. *Probabilistic Models of Brain Function and their Applications to Brain-Computer Interfaces*. Allen Institute for Brain Science, Seattle, December, 2005.
39. *Generative Models for Visual Invariance*. Workshop on Invariant Representations in Vision, Computational and Systems Neuroscience (CoSyNe) workshops, Snowbird, March, 2005.

40. *Visual Attention as Hierarchical Bayesian Inference*. Workshop on Bayesian Approaches to Sensory and Motor Processing, Computational and Systems Neuroscience (CoSyNe) workshops, Snowbird, March, 2005.
41. *A Bayesian Model of Sensorimotor Learning and Imitation in Infants and Robots*. IPAM Workshop on Probabilistic Models of Cognition, UCLA, CA, January 27, 2005.
42. *Probabilistic Models of Cortical Computation*. Okinawa Computational Neuroscience Course, Japan, November 16, 2004.
43. *Probabilistic Models of Cortical Computation and Communication*. Banbury Meeting on Communication in Brain Systems, Cold Spring Harbor Laboratory, NY, May 18, 2004.
44. *Bayesian Computation in Neural Circuits*. Computation and Neural Systems Colloquium, Caltech, Pasadena, CA, April 12, 2004.
45. *Probabilistic Computation in Neural Circuits*. MSRI Workshop on Mathematical Neuroscience, UC Berkeley, CA, March 18, 2004.
46. *Bayesian Computation in Neural Circuits*. Redwood Neuroscience Institute (RNI), Menlo Park, CA, March 16, 2004.
47. *STDP and Predictive Coding*. The Monte-Verita Workshop on Spike-Timing Dependent Plasticity, Ascona, Switzerland, March 3, 2004.
48. *Probabilistic Computation in Neural Systems*. Packard Fellows Annual Meeting, Vancouver, BC, September 5, 2003.
49. *Probabilistic Computation in Recurrent Neural Circuits*. Sloan-Swartz Annual Meeting on Theoretical Neurobiology, Del Mar, CA, July 27, 2003.
50. *Imitation Learning in Infants and Robots: Towards Probabilistic Computational Models*. Keynote talk, Artificial Intelligence and Simulation of Behavior (AISB) Convention 2003: Cognition in Machines and Animals, UK, April 7, 2003.
51. *Bayesian Computation in Recurrent Cortical Circuits*. Neural Information and Coding Workshop, Snowbird, Utah, March 2, 2003.
52. *Probabilistic Computation in Recurrent Cortical Circuits*. Workshop on Neural Coding, Mathematical Biosciences Institute, Ohio State University, February 12, 2003.
53. *Bilinear Models and Lie Groups: Two Approaches to Learning Invariance using Generative Models*. NIPS workshop on Learning Invariant Representations, Whistler B.C., Canada, December 13, 2002.
54. *Bayesian Computation in Recurrent Cortical Circuits*. Workshop on System Level Modeling, Mathematical Biosciences Institute, Ohio State University, November 22, 2002.

55. *Bayesian Inference in Recurrent Cortical Circuits*. National Center for the Biological Sciences, Bangalore, India, August, 2002.
56. *Bayesian Inference in Recurrent Cortical Circuits*. Telluride Workshop on Neuromorphic Engineering, Telluride, Colorado, July 11, 2002.
57. *Spike-Timing Dependent Plasticity and Predictive Coding in the Visual Cortex*. Activity-Dependent Synaptic Plasticity Workshop, Whistler B.C., Canada, December 8, 2002.
58. *Computational Models of the Visual Cortex: From Neurons to Perception*. Department of Bioengineering, University of Utah, Salt Lake City, December 15, 2000.
59. *Predictive Coding in Recurrent Neocortical Circuits*. Neuroinformatics Summer School, Japanese Neural Networks Society, Hayama, Japan, August 11, 2000.
60. *Spike Timing Dependent Plasticity and Sequence Learning in Recurrent Cortical Circuits*. Laboratory for Information Synthesis, Brain Research Institute, RIKEN, Japan, August 9, 2000.
61. *Spike Timing Dependent Plasticity and Motion Detection in Primary Visual Cortex*. Kawato Dynamic Brain Project, ATR, Japan, August 4, 2000.
62. *Modeling the Visual Cortex: From Neurons to Perception*. Biomedical Engineering Department, University of California, Irvine, May 4, 2000.
63. *The Predictive Coding Hypothesis of Cortical Function*. Neuroscience Department, Brown University, April 5, 2000.
64. *Dynamic Vision*. Department of Computer Science, University of Southern California, Los Angeles, March 23, 2000.
65. *From Endstopping to Attention: Insights from the Predictive Coding Hypothesis of Cortical Function*. Center for Neural Science, University of California, Davis, March 17, 2000.
66. *Neurally Inspired Algorithms for Machine Vision and Learning*. Department of Computer Science and Engineering, University of California, San Diego, March 6, 2000; University of Washington, Seattle, March 28, 2000.
67. *Attention as Robust Statistical Filtering*. Neural Mechanisms of Perceptual Selection in Visual and Prefrontal Cortex Workshop, Breckenridge, December, 1999.
68. *Optimal Smoothing in Visual Motion Perception: Evidence from the Flash Lag Effect*. Adaptive Computational Models and Short Time Perceptual Learning Workshop, Breckenridge, December, 1999.
69. *Predictive Learning of Direction Selectivity in Recurrent Neocortical Circuits*. Spike Timing and Synaptic Plasticity Workshop, Breckenridge, December, 1999.

70. *Prediction and Recurrent Excitation in the Neocortex*. Neural Information and Coding Workshop, Big Sky, Montana, March, 1999.
71. *The Predictive Coding Hypothesis of Cortical Function*. Center for Biological and Computational Learning, MIT, April 1998, Center for Visual Science Symposium, University of Rochester, June 1998 and Smith-Kettlewell Eye Institute, San Francisco, July 1998.
72. *Learning Spatiotemporal Generative Models*. Workshop on Computational Neuroscience and Generative Models, University of Toronto, February 1998.
73. *The Cerebral Cortex as a Predictor and Model Builder* (Postdoc Job Talk). The Salk Institute for Biological Studies, February 1997.
74. *The Visual Cortex as a Hierarchical Predictor*. Telluride Workshop on Neuro-morphic Engineering, July 1996.

PERSONAL

US Citizen. Born in Madras, India, July 2, 1970.

**OTHER
INTERESTS**

Indian art, racquetball, table tennis, badminton, yoga.