RAJESH P. N. RAO

Curriculum Vitae

September 2010

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

POSITIONS Associate Professor, Department of Computer Science and Engineering, University of Washington (UW), 2006-present.

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.

Faculty Member, Neurobiology and Behavior Program, UW, 2001-present.

Faculty Member, Faculty of 1000 Biology, Theoretical Neuroscience Section, 2006-present.

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 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. Alpha Chi (National Honor Scholarship), Epsilon Delta Pi (Computer Science), and Pi Mu Epsilon (Mathematics) 1991-1992.

Invited participant, Research Science Institute (RSI) program for high school students, Center for Excellence in Education, Virginia, 1987. Award Paper: *Epitaxy of high-t_c superconductors* (published in Proc. of RSI 1987).

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

TEACHING

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. Syllabus, slides, and course information: http://depts.washington.edu/uwch/courses_graduate_rao_spring_09.htm

Graduate course on Computational Neuroscience (Computational Neuroscience: CSE 528/NEUBEH 528), UW, Spring 2009 and Spring 2007. Textbook: Theoretical Neuroscience by Peter Dayan and Larry Abbott. Syllabus, slides, and course information: www.cs.washington.edu/education/courses/528/09sp/

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/

Undergraduate course on Artificial Intelligence (Introduction to Artificial Intelligence: CSE 473), UW, Autumn 2006. Textbook: Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig. Syllabus, slides, and course information: www.cs.washington.edu/education/courses/473/06au/

Graduate course on Brain-Computer Interfaces (CSE 599E), UW, Spring 2006. Syllabus, slides, and course information: www.cs.washington.edu/education/courses/599e/06sp/

Undergraduate course on Theory of Computation (Introduction to Formal Models in Computer Science: CSE 322), UW, 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/

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. Undergraduate courses on fundamentals of physics.

GRADUATE MENTORING (CURRENT)

Abe Friesen, graduate student, Computer Science and Engineering. Topic: Imitation Learning.

Tim Blakely, graduate student, Bioengineering. Research Topic: Brain-Machine Interfaces.

Yanping Huang, graduate student, Physiology and Biophysics.

Xu Miao, graduate student, CSE. Research Topic: Learning in machine vision.

Kai Miller, graduate student, Neurobiology and Behavior Program, UW. Research Topic: Brain decoding during cognitive tasks.

GRADUATE MENTORING (PAST)

Pradeep Shenoy, CSE, PhD: Spring 2008. PhD Thesis: Brain-Computer Interfaces for Control and Computation. Current Employment: UCSD post-doc.

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: NeuroVista, Seattle.

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

UNDERGRAD MENTORING (CURRENT)

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

Michael Chung and Willy Cheung, undergraduate students, CSE. Research Topic: Robotics and Imitation Learning.

UNDERGRAD MENTORING (PAST)

Gabriel Maganis and Danny Rashid, undergraduate students, CSE. Research Topic: Humanoid Robotics. Presently graduate students 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.

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. Presently a graduate student at UBC.

Chris Baker, undergraduate student and Mary Gates scholar, Early Identification Pro-

gram, CSE, 2002-2004. Research Topic: Neural Computation with Dynamic Synapses. Presently a graduate 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.

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, 2009-present.

CSE Broadening Participation Committee, 2009-present.

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 Lund-

berg, Tracy Bartholomew, Chris Cunnington).

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

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

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 Ke Zheng, Zasha Weinberg, David Hsu, and Yung-Yu Chuang.

UNIVERSITY SERVICE

Committee Member: Neurobiology and Behavior Development Committee, September 2008-present.

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: Yanping Huang, Erick Chastain, Kai Miller, Alex Dieudonne, Tim Hanks, Brian Lundstrom, and Jeff Longnion, UW Neurobiology and Behavior Program and UW Medical Scientist Training Program.

CROSS-CAMPUS PARTNERSHIPS

Collaborative research on *Imitation Learning in Infants and Robots* with Andrew Meltzoff (co-director, UW Institute for Learning and Brain Sciences), 2002-present.

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

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: Cognitive Science Journal, 2007-present. Machine Learning Journal and Autonomous Robots Journal (Joint Special Issue on Learning in Autonomous Robots, 1998); Neural Computation (Communicating Reviewer).

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

Workshops Co-Chair: Neural Information Processing Systems (NIPS), 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: 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): Indiana 21st Century Research and Technology Fund, National Science Foundation (NSF) Emerging Technologies (EMT) review panel, NSF CAREER award review panel, NSF postdoctoral fellowship review, NIMH grant review.

Organizations: Association of 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, neural engineering, brain-computer interfaces, and humanoid robotics.

PUBLICATIONS

Books

1. *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.

2. *The 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

3. "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.

4. "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 Reviews

5. "Probabilistic Analysis of an Ancient Undeciphered Script," R. P. N. Rao, *IEEE Computer*, 2010 (to appear).

6. "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*, 2010 (to appear).

7. "Non-Manual Control Devices: Direct Brain-Computer Interaction," Reinhold Scherer and Rajesh P. N. Rao, *Handbook of Research on Personal Autonomy Technologies and Disability Informatics*, Hershey, PA: IGI Global Publishers, 2010 (to appear).

8. "Learning Actions through Imitation and Exploration: Towards Humanoid Robots That Learn from Humans," D. B. Grimes and R. P. N. Rao, B. Sendhoff et al. (eds.), *Creating Brain-Like Intelligence*, Springer, 103-138, 2009.

9. "Bayesian Cortical Models," Rajesh P. N. Rao, *The New Encyclopedia of Neuroscience*, Elsevier Science Ltd., UK, 2007.

10. "Probabilistic Models of Attention based on Iconic Representations and Predictive Coding," Rajesh P. N. Rao and Dana H. Ballard, *Neurobiology of Attention*, Elsevier, San Diego, CA, 2005.

11. "Receptive Field," Rajesh P. N. Rao, *Encyclopedia of the Human Brain*, Academic Press, San Diego, CA, 2002.

12. "Models of Attention," Rajesh P. N. Rao, *Encyclopedia of Cognitive Science*, Macmillan Publishers, UK, 2002.

Research Articles: Computational Neuroscience and Brain-Computer Interfaces

13. K. J. Miller, G. Schalk, E. Fetz, M. den Nijs, J. G. Ojemann, R. P. N. Ra.o. "Cortical activity during motor execution, motor imagery, and imagery-based online feedback," *Proceedings of the National Academy of Sciences (PNAS)*, 2010 (to appear).

14. F. Darvas, R. Scherer, J. G. Ojemann, R. P. N. Rao, K. J. Miller, L. B. Sorensen. "High gamma mapping using EEG," *Neuroimage*, 49(1):930-938, 2010.

15. K. J. Miller, D. Hermes, G. Schalk, N. F. Ramsey, B. Jagadeesh, M. den Nijs, J. G. Ojemann, R. P. N. Rao. "Detection of spontaneous class-specific visual stimuli with high temporal accuracy in human electrocorticography," *Conf Proc IEEE Eng Med Biol Soc.*, 1:6465-6468, 2009.

16. R. Scherer, S. P. Zanos, K. J. Miller, R. P. N. Rao, J. G. Ojemann."Classification of contralateral and ipsilateral finger movements for electrocorticographic brain-computer interfaces," *Neurosurgical Focus*, 27(1):E12, 2009.

17. T. Blakely, K. J. Miller, S. Zanos, R. P. N. Rao, J. G. Ojemann. "Robust long term control of an electrocorticographic brain computer interface with fixed parameters," *Neurosurgical Focus*, 27(1):E13, 2009.

18. F. Darvas, K. J. Miller, R. P. Rao, J. G. Ojemann. "Nonlinear phase-phase cross-frequency coupling mediates communication between distant sites in human neocortex," *J. Neurosci.*, 29(2):426-35, 2009. Rated **Must Read** and evaluated by Wolf Singer in *Faculty of 1000 Biology*.

19. T. Blakely, K. J. Miller, R. P. N. Rao, M. D. Holmes, J. G. Ojemann. "Localization and classification of phonemes using high spatial resolution electrocorticography (ECoG) grids," *Conf Proc IEEE Eng Med Biol Soc.*, 1:4964-4967, 2008.

20. K. J. Miller, T. Blakely, G. Schalk, M. den Nijs, R. P. N. Rao, J. G. Ojemann. "Three cases of feature correlation in an electrocorticographic BCI," *Conf Proc IEEE Eng Med Biol Soc.* 1:5318-5321, 2008.

21. C. J. Bell, P. Shenoy, R. Chalodhorn, R. P. N. Rao. "Control of a humanoid robot by a noninvasive brain-computer interface in humans," **Featured Cover Article**, *J Neural Eng*, 5(2):214-20, 2008.

22. P. Shenoy, K. J. Miller, B. Crawford, R. P. N. Rao. "Online electromyographic control of a robotic prosthesis," *IEEE Trans Biomed Eng*, 55(3):1128-35, 2008.

23. David B. Grimes, Desney S. Tan, Scott E. Hudson, Pradeep Shenoy, Rajesh P. N. Rao. "Feasibility and pragmatics of classifying working memory load with an electroencephalograph," **Best Paper Honorable Mention**, *Proceedings of the 2008 Conference on Computer-Human Interaction (CHI)*, 835-844, 2008.

24. K. J. Miller, P. Shenoy, M. den Nijs, L. B. Sorensen, R. P. N. Rao, J. G. Ojemann. "Beyond the gamma band: the role of high-frequency features in movement classification," *IEEE Trans Biomed Eng*, 55(5):1634-7, 2008.

25. P. Shenoy, K. J. Miller, J. G. Ojemann, R. P. N. Rao. "Generalized features for electrocorticographic BCIs," *IEEE Trans Biomed Eng.*, 55(1):273-80, 2008.

26. K. J. Miller, A. O. Hebb, J. G. Ojemann, R. P. Rao, M. den Nijs. "Task-related principal component analysis: formalism and illustration," *Conf Proc IEEE Eng Med Biol Soc. 2007*, 5469-72, 2007.

27. K .J. Miller, M. den Nijs, P. Shenoy, J. W. Miller, R. P. N. Rao, J. G. Ojemann. "Real-time functional brain mapping using electrocorticography," *Neuroimage*, 37(2):504-507, 2007.

28. K. J. Miller ,G. Schalk, E. C. Leuthardt, P. Shenoy, R. P. N. Rao, J. G. Ojemann, "Correlation in Paired One-Dimensional, Closed Loop, Overt, Motor Controlled BCI," *Journal of Technical University of Graz, Special Issue: Brain Computer Interfaces*, 2007.

29. P. Shenoy, K.J. Miller, J.G. Ojemann, R.P.N. Rao. "Two class robust classification of ECoG signals during repeated motor movement," *Journal of Technical University of Graz, Special Issue: Brain Computer Interfaces*, 2007.

30. K. J. Miller, R. P. N. Rao, J. G. Ojemann, "The Behavioral Split in the Gamma Band," *Proceedings of the 3rd International IEEE/EMBS Conference*, 465-468, 2007.

31. Rajesh P. N. Rao, Aaron P. Shon, and Andrew N. Meltzoff. "A Bayesian Model of Imitation in Infants and Robots," in *Imitation and Social Learning in Robots, Humans and Animals: Behavioural, Social and Communicative Dimensions*, K. Dautenhahn and C. L. Nehaniv (eds.), Cambridge University Press, UK, 217-247, 2007.

32. K. J. Miller, S. Makeig, A. O. Hebb, R. P. N. Rao, M. den Nijs, J. G. Ojemann. "Cortical electrode localization from X-rays and simple mapping for electrocorticographic research: The "Location on Cortex" (LOC) package for MATLAB," *J. Neurosci. Methods*, 162(1-2):303-308, 2007.

33. Kai J. Miller, Eric C. Leuthardt, Gerwin Schalk, Rajesh P. N. Rao, et al. "Spectral Changes in Cortical Surface Potentials during Motor Movement", *The Journal of Neuroscience*, 27(9):2424-32, 2007.

34. Pradeep Shenoy, Kai J. Miller, Jeffrey G. Ojemann, and Rajesh P. N. Rao. "Finger Movement Classification for an Electrocorticographic BCI," *The 3rd International IEEE EMBS Conference on Neural Engineering*, 192-195, 2007.

35. Christian J. Bell, Pradeep Shenoy, Rawichote Chalodhorn, and Rajesh P. N. Rao. "An Image-based Brain-Computer Interface Using the P3 Response," *The 3rd International IEEE EMBS Conference on Neural Engineering*, 2007.

36. Pradeep Shenoy, Matthias Krauledat, Benjamin Blankertz, Rajesh P. N. Rao and Klaus-Robert Mueller. "Towards adaptive classification for BCI" *The Journal of Neural Engineering*, 3(1):R13-23, 2006.

37. Eric C. Leuthardt, Kai J. Miller, Gerwin Schalk, Rajesh P. N. Rao, and Jeffrey G. Ojemann. "Electrocorticography-based Brain Computer interface - the Seattle experience" *IEEE Trans Neural Syst Rehab Eng*, 14(2), pp. 194-198, 2006.

38. Rajesh P. N. Rao. "Neural models of Bayesian belief propagation," in *The Bayesian Brain: Probabilistic Approaches to Neural Coding*, Doya K, Ishii S, Pouget A, Rao RPN (Eds.), Cambridge, MA: MIT Press, 2007.

39. Matt Hoffman, David B. Grimes, Aaron P. Shon, and Rajesh P. N. Rao. "A Probabilistic Model of Gaze Imitation and Shared Attention," *Neural Networks*, 19(3), 299-310, 2006.

40. Deepak Verma and Rajesh P. N. Rao. "Goal-Based Imitation as Probabilistic Inference over Graphical Models," *Advances in Neural Information Processing Systems 18*, Cambridge, MA: MIT Press, 1393-1400, 2006.

41. Rajesh P. N. Rao. "Bayesian Inference and Attentional Modulation in the Visual Cortex," *Neuroreport*, 16(16), 1843-1848, 2005.

42. K. J. Miller, G. Schalk, J. W. Miller, R. P. N. Rao, E. C. Leuthardt, J. M. Zacks, and J. G. Ojemann. "Selective attention effects associated with very high frequency changes in human primary visual cortex," *Soc Neurosci Abs*, 2005.

43. Rajesh P. N. Rao. "Hierarchical Bayesian Inference in Networks of Spiking Neurons," *Advances in Neural Information Processing Systems 17*, Cambridge, MA: MIT Press, 1113-1120, 2005.

44. Pradeep Shenoy and Rajesh P. N. Rao. "Dynamic Bayesian Networks for Brain-Computer Interfaces," *Advances in Neural Information Processing Systems 17*, Cambridge, MA: MIT Press, 1265-1272, 2005.

45. David B. Grimes and Rajesh P. N. Rao. "Sparse Bilinear Models for Invariant Vision," *Neural Computation*, 17(1):47-73, 2005.

46. Beau Crawford, Kai Miller, Pradeep Shenoy and Rajesh P. N. Rao, "Real-Time Classification of Electromyographic Signals for Robotic Control," *Proceedings of AAAI-05*, 523-528, 2005.

47. Rajesh P. N. Rao. "Bayesian Computation in Recurrent Neural Circuits," *Neural Computation*, 16(1):1-38, 2004.

48. Aaron P. Shon, Rajesh P. N. Rao, and Terrence J. Sejnowski. "Motion Detection and Prediction through Spike-Timing Dependent Plasticity," *Network: Computation in Neural Systems*, 15:179-198, 2004.

49. Aaron P. Shon and Rajesh P. N. Rao. "Implementing Belief Propagation in Neural Circuits," *Neurocomputing*, 65-66:393-399, 2005.

50. Chris L. Baker, Aaron P. Shon, and Rajesh P. N. Rao. "Learning Temporal Clusters with Synaptic Facilitation and Lateral Inhibition," *Neurocomputing*, 65-66, 2005.

51. Aaron P. Shon, David B. Grimes, Chris L. Baker, and Rajesh P. N. Rao. "A Probabilistic Framework for Model-Based Imitation Learning," *Proc. of the 26th Annual Meeting of the Cognitive Science Society*, 2004.

52. Rajesh P. N. Rao and Terrence J. Sejnowski. "Self-Organizing Neural Systems based on Predictive Learning" (Invited Paper) *Philosophical Transactions of the Royal Society: Mathematical, Physical and Engineering Sciences* (Proceedings of the Nobel Symposium on Self-Organization), 361(1807), 2003.

53. Rajesh P. N. Rao and Andrew N. Meltzoff. "Imitation Learning in Infants and Robots: Towards Probabilistic Computational Models" (Invited Paper) *Proceedings of Artificial Intelligence and Simulation of Behavior (AISB) 2003: Cognition in Machines and Animals*, UK, 2003.

54. David B. Grimes and Rajesh P. N. Rao. "A Bilinear Model for Sparse Coding" *Advances in Neural Information Processing Systems 15*, 1287-1294, Cambridge, MA: MIT Press, 2003.

55. Aaron P. Shon and Rajesh P. N. Rao. "Learning Temporal Patterns by Redistribution of Synaptic Efficacy" *Neurocomputing*, 52-54:13-18, 2003.

56. Rajesh P. N. Rao and Terrence J. Sejnowski. "Complex Cell-Like Direction Selectivity through Spike-Timing Dependent Plasticity" *IETE Journal of Research*, 49(2), 2003.

57. Rajesh P. N. Rao, Gregory J. Zelinsky, Mary M. Hayhoe, and Dana H. Ballard. "Eye Movements in Iconic Visual Search" *Vision Research*, 42(11):1447-1463, 2002.

58. Rajesh P. N. Rao and Terrence J. Sejnowski. "Spike Timing Dependent Hebbian Plasticity as Temporal Difference Learning" *Neural Computation*, 13(10):2221-2237, 2001. Featured in a **News and Views** article by Peter Dayan in *Trends in Cognitive Science*, 6(3):105-106, 2002.

59. Rajesh P. N. Rao and Terrence J. Sejnowski. "Predictive Coding, Cortical Feedback, and Spike-Timing Dependent Plasticity" in *Probabilistic Models of the Brain: Perception and Neural Function*, R. P. N. Rao, B. A. Olshausen and M. S. Lewicki (Eds.), Cambridge, MA: MIT Press, 297-315, 2002.

60. Dana H. Ballard, Zuohua Zhang, and Rajesh P. N. Rao. "Distributed Synchrony: A Probabilistic Model of Neural Signaling" in *Probabilistic Models of the Brain: Perception and Neural Function*, R. P. N. Rao, B. A. Olshausen and M. S. Lewicki (Eds.), Cambridge, MA: MIT Press, 273-283, 2002.

61. Rajesh P. N. Rao, David Eagleman, and Terrence J. Sejnowski. "Optimal Smoothing in Visual Motion Perception" *Neural Computation*, 13(6):1243-1253, 2001.

62. J. M. Fellous, A. R. Houweling, R. H. Modi, R. P. N. Rao, P. H. E. Tiesinga, and T. J. Sejnowski. "The Frequency Dependence of Spike Timing Reliability in Cortical Pyramidal Cells and Interneurons" *J. Neurophysiology*, 85(4):1782-1787, 2001.

63. Rajesh P. N. Rao and Terrence J. Sejnowski. "Predictive Learning of Temporal Sequences in Recurrent Neocortical Circuits" *Novartis Foundation 2001 Symposium on Complexity in Biological Info. Processing*, 239:208-229 (discussion: 229-240), 2001.

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Research Articles: Probabilistic Analysis of Ancient Scripts

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Research Articles: Psychophysics

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PRESS COVERAGE

1. Quoted in *CNN* article "The future of brain-controlled devices," January, 2010.

2. Quoted in *TechNewsWorld* article "Toyota Wheelchair Guided by Thought Alone," June, 2009.

3. *Science* and *PNAS* articles on Indus script covered worldwide (April-September, 2009): *Time magazine*, *BBC*, *Wired*, *Discovery Channel*, *Smithsonian magazine*, *MSNBC*, *The Guardian*, *Physics Today*, *Science Daily*, *Nature India*, *Scientific American (India)*, *The Telegraph (Calcutta)*, *The Hindu*, *Times of India*, *Asia Times*, *New Scientist*, *Xinhua*, *Daily News & Analysis*, *Deccan Chronicle*, *Livemint*, *Sydney Morning Herald*, etc.

4. Featured segment on *CBS News Sunday Morning* with Bill Geist on our brain-controlled robot research, May 20, 2007.

5. Featured segment on *ABC News: Ahead of the Curve* on our brain-controlled robot research, May, 2007.

6. 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.

7. Interview for *Seattle Times* for their Front Page article on our research: "Robot puts human thoughts into action", January, 2007.

8. Interview for *KING 5 TV* (Seattle) for their news segment on our brain-computer interface for controlling a humanoid robot, February, 2007.

9. 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.

10. Quoted in a story on building neural circuits in silicon. *New York Times*, page D12, June 29, 2000.

11. Rajesh P. N. Rao. "Building Computers That See, Adapt and Learn" Translated article (in Kannada) appeared in *Udayavani Kannada Daily* (India), July 21, 1996.

12. Quoted in a story describing our group's mobile robot research (see above). *Rochester Democrat and Chronicle* (Daily), page 8B, December 22, 1994.

13. Brief television interviews on mobile robot research. Rochester News Channel 13 and Rochester Independent News, December 1994.

INVITED TALKS

1. *A Neural Model of Model-Based Action Selection and Decision Making*, Workshop on Goal Directed Decision Making: Behavior, Neuroscience and Computation, Princeton University, October 23-24, 2009.

2. *Compact Course on Brain Computer Interfaces*, Indian Institute of Science, Bangalore, India, February 5-8, 2008.

3. *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.

4. *Controlling Cursors and Robots by Thought: Brain-Computer Interface Research at the University of Washington*, AIST, Japan, 19 November, 2007.

5. *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.

6. *Creating a Bayesian Brain: Lessons from Neuroscience and Robotics*. Honda International Symposium on "Creating Brain-like Intelligence", Hohenstein, Germany, February, 2007.

7. *The Mind-Body Connection*. 2006 Engineering Lecture Series, University of Washington, October, 2006.

8. *Graphical Models for Sensorimotor Learning*. NIPS Workshop on Grounding Perception, Knowledge and Cognition in Sensori-Motor Experience, December, 2006.

9. *Action as Bayesian Inference*. Computation and Neural Systems Program, Caltech, May, 2006.

10. *Synaptic Plasticity and Probabilistic Inference in Neuronal Networks*. Gordon Research Conference on Theoretical Biology and Biomathematics, Tilton, NH, June, 2006.

11. *Action as Bayesian Inferece*. Workshop on Bayesian Cognition, Paris, January, 2006.

12. *Probabilistic Models of Brain Function and their Applications to Brain-Computer Interfaces*. Allen Institute for Brain Science, Seattle, December, 2005.

13. *Generative Models for Visual Invariance*. Workshop on Invariant Representations in Vision, Computational and Systems Neuroscience (CoSyNe) workshops, Snowbird, March, 2005.

14. *Visual Attention as Hierarchical Bayesian Inference*. Workshop on Bayesian Approaches to Sensory and Motor Processing, Computational and Systems Neuroscience (CoSyNe) workshops, Snowbird, March, 2005.

15. *A Bayesian Model of Sensorimotor Learning and Imitation in Infants and Robots*. IPAM Workshop on Probabilistic Models of Cognition, UCLA, CA, January 27, 2005.

16. *Probabilistic Models of Cortical Computation*. Okinawa Computational Neuroscience Course, Japan, November 16, 2004.

17. *Probabilistic Models of Cortical Computation and Communication*. Banbury Meeting on Communication in Brain Systems, Cold Spring Harbor Laboratory, NY, May 18, 2004.

18. *Bayesian Computation in Neural Circuits*. Computation and Neural Systems Colloquium, Caltech, Pasadena, CA, April 12, 2004.

19. *Probabilistic Computation in Neural Circuits*. MSRI Workshop on Mathematical Neuroscience, UC Berkeley, CA, March 18, 2004.

20. *Bayesian Computation in Neural Circuits*. Redwood Neuroscience Institute (RNI), Menlo Park, CA, March 16, 2004.

21. *STDP and Predictive Coding*. The Monte-Verita Workshop on Spike-Timing Dependent Plasticity, Ascona, Switzerland, March 3, 2004.

22. *Probabilistic Computation in Neural Systems*. Packard Fellows Annual Meeting, Vancouver, BC, September 5, 2003.

23. *Probabilistic Computation in Recurrent Neural Circuits*. Sloan-Swartz Annual Meeting on Theoretical Neurobiology, Del Mar, CA, July 27, 2003.

24. *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.

25. *Bayesian Computation in Recurrent Cortical Circuits*. Neural Information and Coding Workshop, Snowbird, Utah, March 2, 2003.

26. *Probabilistic Computation in Recurrent Cortical Circuits*. Workshop on Neural Coding, Mathematical Biosciences Institute, Ohio State University, February 12, 2003.

27. *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.

28. *Bayesian Computation in Recurrent Cortical Circuits*. Workshop on System Level Modeling, Mathematical Biosciences Institute, Ohio State University, November 22, 2002.

29. *Bayesian Inference in Recurrent Cortical Circuits*. National Center for the Biological Sciences, Bangalore, India, August, 2002.

30. *Bayesian Inference in Recurrent Cortical Circuits*. Telluride Workshop on Neuromorphic Engineering, Telluride, Colorado, July 11, 2002.

31. *Spike-Timing Dependent Plasticity and Predictive Coding in the Visual Cortex*. Activity-Dependent Synaptic Plasticity Workshop, Whistler B.C., Canada, December 8, 2002.

32. *Computational Models of the Visual Cortex: From Neurons to Perception*. Department of Bioengineering, University of Utah, Salt Lake City, December 15, 2000.

33. *Predictive Coding in Recurrent Neocortical Circuits*. Neuroinformatics Summer School, Japanese Neural Networks Society, Hayama, Japan, August 11, 2000.

34. *Spike Timing Dependent Plasticity and Sequence Learning in Recurrent Cortical Circuits*. Laboratory for Information Synthesis, Brain Research Institute, RIKEN, Japan, August 9, 2000.

35. *Spike Timing Dependent Plasticity and Motion Detection in Primary Visual Cortex*. Kawato Dynamic Brain Project, ATR, Japan, August 4, 2000.

36. *Modeling the Visual Cortex: From Neurons to Perception*. Biomedical Engineering Department, University of California, Irvine, May 4, 2000.

37. *The Predictive Coding Hypothesis of Cortical Function*. Neuroscience Department, Brown University, April 5, 2000.

38. *Dynamic Vision*. Department of Computer Science, University of Southern California, Los Angeles, March 23, 2000.

39. *From Endstopping to Attention: Insights from the Predictive Coding Hypothesis of Cortical Function*. Center for Neural Science, University of California, Davis, March 17, 2000.

40. *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.

41. *Attention as Robust Statistical Filtering*. Neural Mechanisms of Perceptual Selection in Visual and Prefrontal Cortex Workshop, Breckenridge, December, 1999.

42. *Optimal Smoothing in Visual Motion Perception: Evidence from the Flash Lag Effect*. Adaptive Computational Models and Short Time Perceptual Learning Workshop, Breckenridge, December, 1999.

43. *Predictive Learning of Direction Selectivity in Recurrent Neocortical Circuits*. Spike Timing and Synaptic Plasticity Workshop, Breckenridge, December, 1999.

44. *Prediction and Recurrent Excitation in the Neocortex*. Neural Information and Coding Workshop, Big Sky, Montana, March, 1999.

45. *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.

46. *Learning Spatiotemporal Generative Models*. Workshop on Computational Neuroscience and Generative Models, University of Toronto, February 1998.

47. *The Cerebral Cortex as a Predictor and Model Builder* (Postdoc Job Talk). The Salk Institute for Biological Studies, February 1997.

48. *The Visual Cortex as a Hierarchical Predictor*. Telluride Workshop on Neuromorphic Engineering, July 1996.

OTHER INTERESTS Indian art, racquetball, squash, table tennis, badminton, yoga.