

PRADEEP SHENOY

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- RESEARCH INTERESTS** I am primarily interested in theoretical neuroscience and cognitive psychology, and their applications to psychiatry and neuropharmacology. I use statistical and control-theoretic analysis to study decision making, learning and associated behavior in humans and animals.
- For my doctoral dissertation, I designed and built a variety of brain-computer interfaces, exploring the interplay between brain signal decoding and application context. I analyzed and used a variety of biosignals (EEG, ECG, EMG) for applications in robotics, human-computer interfaces and rehabilitation. I have also worked on a number of problems in database research, including algorithms for indexing and navigation of semistructured data, and query result caching in databases.
- EDUCATION** **University of Washington, Seattle, WA USA**
Ph.D. (Computer Science), 2008
 - Dissertation Topic: "Brain-Computer Interfaces for Control and Computation"
 - Advisor: Rajesh P.N. RaoM.S. (Computer Science), 2004
Indian Institute of Technology, Bombay, India
B.Tech (Computer Science), 1999
- RESEARCH EXPERIENCE** **University of California, San Diego, San Diego, CA USA**
Postdoctoral Associate (Mentor: Angela J. Yu) **Jan 2010 - present**
- I investigate the computational, cognitive and neurophysiological basis of inhibitory control. I develop computational models for well-studied experimental paradigms (the stop signal task, and the go-nogo task) that probe behavioral inhibition and its deficits. We analyze data from behavioral, neural (EEG, fMRI, single-neuron), and pharmacological experiments from the perspective of our computational framework. I am also working to understand observed performance deficits in individuals with ADHD and substance abuse problems.
- University of Washington, Seattle, WA USA**
Postdoctoral Associate (Mentor: Rajesh P.N. Rao) **Jun 2008 - Dec 2009**
- Designing an optimality framework to study human and animal behavior in the countermanding task paradigm, in collaboration with Angela Yu at UCSD.
- Modeling decision uncertainty in rats, in collaboration with Adam Kepecs at Cold Spring Harbor Laboratory.
- Audited courses in the departments of Neurobiology& Behavior and Psychology.
- NB501: Cellular and Molecular Neuroscience
 - NB502: Neuroanatomy
 - NB503: Cognitive and Systems Neuroscience
 - PSY448a: Topics in Vision (Instructor: Geoff Boynton)

- PSY506: Core Concepts in Cognitive Neuroscience (Instructor: Scott Murray and Lee Osterhout)
- PSY548: Bayesian Reasoning in Psychology (Instructor: John Miyamoto)

Research Assistant

Jun 2002 - May 2008

- Designed classifier-based techniques and an online system for using electrocorticographic signals in multi-class BCIs.
- Designed an image-based noninvasive brain interface for control of a humanoid robot.
- Developed a system for controlling a robotic arm using Electromyographic signals.
- Applied dynamic Bayesian networks for building models of user behavior in BCIs.

Microsoft Research, Redmond, WA USA

Consulting work (Mentor: Desney S. Tan)

Aug 2007 - May 2008

Combined and contrasted an EEG-based image labeling system with computer vision algorithms.

Research Intern (Mentor: Desney S. Tan)

Jan - Mar, 2007

Designed a system for labeling images based on EEG brain responses.

Fraunhofer Institute, Berlin, Germany

Visiting Researcher (Mentor: Klaus-Robert Mueller)

Jul - Oct, 2005

Developed and evaluated adaptive algorithms for the Berlin Brain-Computer Interface.

Bell Laboratories, Murray Hill, NJ USA

Research Intern (Mentor: Philip Bohannon)

Jun - Sep, 2001

Worked on novel query processing and optimization techniques for the ROLEX project. The goal of ROLEX is to provide fast on-demand navigational access to relational data via an XML wrapper.

Member of Technical Staff (Mentor: Henry F. Korth)

Nov 1999 - Aug 2000

Developed novel techniques for indexing semistructured data. I also worked on the AQUA approximate query answering project.

TEACHING & MENTORING

University of California, San Diego, San Diego, CA USA

Instructor, COGS118A (Natural Computation)

Winter 2012

I will teach an introductory class on probability theory and statistical methods for undergraduates in Cognitive Science.

University of Washington, Seattle, WA USA

TA and Co-Designer, Brain-Computer Interfaces Course

Spring 2006

Developed the course structure, reading list and course projects. Helped coordinate class discussions, gave introductory lectures and supervised student projects. Course material available online at <http://www.cs.washington.edu/education/courses/cse599e/06sp/>.

Research Supervision

2006 - 2007

Mentored two research assistants in the design of experiments, algorithms, analysis methods and online systems for a variety of brain-computer interface paradigms. Part of this work was published in the *Journal of Neural Engineering* (2008), and at the Graz conference on brain-computer interfaces (2006).

Mentor for Undergraduate Research

2004 - 2005

Supervised 3 undergraduate honors theses on topics in Brain-Computer Interfaces. Guided undergraduates through research projects involving development of a novel EMG-based prosthetic interface, and large-margin methods for robust classification of ECoG signals in Brain-Computer Interfaces. Part of this work was extended into a paper at AAAI 2005.

Tutoring for Undergraduates

2003

Volunteered as tutor for CS undergraduates taking courses in discrete mathematics and theoretical computer science.

Teaching Assistant, CSE 322

Autumn 2002

Graded homeworks and exams, conducted office hours and taught guest lectures for an undergraduate course in theoretical computer science.

Teaching Assistant, CSE 142

Spring 2002

Taught two weekly sections for a campus-wide introductory computer programming course.

PUBLICATIONS

Neuroscience & Psychology

P. Shenoy, A. J. Yu. (2011 *in preparation*). Rational anticipation, norepinephrine, and inhibitory control.

P. Shenoy, A. J. Yu. (2011, *in preparation*). Optimal Bayesian inference and risk minimization underlies human behavior in perceptual decision making.

J.S. Ide, P. Shenoy, A.J. Yu, C-S.R. Li. (2011, *in preparation*). Bayesian predictions and evaluation in the anterior cingulate cortex.

P. Shenoy, A. J. Yu (2011). Rational decision-making in inhibitory control. *Frontiers in Human Neuroscience* 5:48, 2011.

P. Shenoy, R.P.N. Rao, A. J. Yu (2010). A rational decision-making framework for inhibitory control. *Advances in Neural Information Processing Systems* 23.

Neuroscience Abstracts

Rational decision-making underlies systematic differences in speed and accuracy between 2-alternative forced choice tasks and Go/NoGo tasks. P. Shenoy, A.J. Yu. Society for Neuroscience (SfN) Abstracts, 2011.

A computational model of norepinephrine and inhibitory control. P. Shenoy, A.J. Yu. Society for Neuroscience (SfN) Abstracts, 2011.

Bayesian predictions and evaluation in the anterior cingulate cortex. J.S. Ide, P. Shenoy, A.J. Yu, C-S.R. Li. Society for Neuroscience (SfN) Abstracts, 2011.

Wherefore a race model: Inhibitory control as optimal decision-making. P. Shenoy, A.J. Yu. Computational and Systems Neuroscience (COSYNE) 2011.

Optimal decision-making and inhibitory control in the stop-signal task: Go and stop latencies both depend on go stimulus difficulty. P. Shenoy, J. Schilz, A.J. Yu. Society for Neuroscience (SfN) Abstracts, 2010.

An optimality framework for understanding the psychology and neurobiology of inhibitory control. P. Shenoy, R.P.N. Rao, A.J. Yu. Computational and Systems Neuroscience (COSYNE) 2010.

An optimality framework for understanding inhibitory control in countermanding tasks. P. Shenoy, R.P.N. Rao, A.J. Yu. Society for Neuroscience (SfN) Abstracts, 2009.

Active updating of decision boundaries in rats can be explained using bayesian classifiers. P. Shenoy, E.J. Chastain, A. Kepecs, R.P.N. Rao. Computational and Systems Neuroscience (COSYNE) 2009.

Risk Taking as Exploration in a Fast-Changing World. E.J. Chastain, P. Shenoy, R.P.N. Rao. Computational

and Systems Neuroscience (COSYNE) 2008.

2004-2008: Refereed articles on Brain-Computer Interfaces

C.J. Bell, P. Shenoy, R. Chalodhorn, R. Rao (2008). Control of a Humanoid Robot by a Noninvasive Brain-Computer Interface in Humans. *J Neural Eng* 5, 214-220.

P. Shenoy, K.J. Miller, J. Ojemann, R. Rao (2008). Generalized Features for Electrographic BCIs. *IEEE Trans Biomed Engg* 55(1) 273-280.

A. Kapoor, D. Tan, P. Shenoy, E. Horvitz (2008). Complementary Computing for Visual Tasks: Meshing Computer Vision with Human Visual Processing. *IEEE Intl Conf on Automatic Face and Gesture Recognition*.

A. Kapoor, P. Shenoy, D.S. Tan (2008). Combining Brain Computer Interfaces With Vision for Object Categorization. *Computer Vision and Pattern Recognition (CVPR) 2008*.

P. Shenoy, D. S. Tan (2008). Human-aided Computing: Utilizing Implicit Human Processing to Classify Images. *ACM Conference on Human Factors in Computing (CHI) 2008*.

D. Grimes, D. Tan, S. Hudson, P. Shenoy, R. Rao (2008). Feasibility and Pragmatics of Classifying Working Memory Load with an Electroencephalograph. *ACM Conference on Human Factors in Computing (CHI) 2008*.

P. Shenoy, K.J. Miller, B. Crawford, R. Rao (2008). Online Electromyographic Control of a Robotic Prosthesis. *IEEE Trans Biomed Engg* 55(3) 1128-1135.

K.J. Miller, P. Shenoy, M. den Nijs, L.B. Sorensen, R. Rao, J. Ojemann (2008). Beyond the Gamma Band: The Role of High Frequency Features in Movement Classification. *IEEE Trans Biomed Engg* 55(5) 1634-1637.

P. Shenoy, K.J. Miller, J. Ojemann, R. Rao (2007). Finger Movement Classification for an Electrographic BCI. *IEEE EMBS Conf. Neur Engg* 2007.

C.J. Bell, P. Shenoy, R. Chalodhorn, R. Rao (2007). An Image-based Brain-Computer Interface Using the P3 Response. *IEEE EMBS Conf. Neur Engg* 2007.

K.J. Miller, M. denNijs, P. Shenoy, R. Rao, J. Ojemann (2007). Real-time Functional Brain Mapping using Electrographic. *NeuroImage* 37(2) 504-507.

P. Shenoy, M. Krauledat, B. Blankertz, R. Rao, K.-R. Mueller (2006). Towards Adaptive Classification for BCI. *J Neural Eng* 3.

M. Krauledat, P. Shenoy, B. Blankertz, R. Rao. K.-R. Mueller. Adaptation in CSP-based BCI systems (book chapter). *Toward Brain-Computer Interfacing*, MIT Press, 2007.

Beau Crawford, Kai Miller, Pradeep Shenoy, Rajesh Rao (2005). Realtime Classification of Electromyographic Signals for Prosthetics. *Association for Advancement of Artificial Intelligence (AAAI) 2005*.

Pradeep Shenoy, Rajesh Rao (2004). Dynamic Bayes Networks for Brain-Computer Interfacing. *Advances in Neural Information Processing Systems (NIPS)*.

2000-2003: Refereed articles on database systems

Jayant Madhavan, Philip Bernstein, Kuang Chen, Alon Halevy, Pradeep Shenoy. Corpus-based Schema Matching. Workshop on Information Integration and the Web, IJCAI 2003.

P. Bohannon, S. Ganguly, H.F. Korth, PPS. Narayan, P. Shenoy. Optimizing View Queries in ROLEX to Support Navigable Result Trees. VLDB 2002.

Raghav Kaushik, Philip Bohannon, Jeff Naughton, Pradeep Shenoy. Updates for Structure Indexes. VLDB 2002.

Raghav Kaushik, Pradeep Shenoy, Philip Bohannon, Ehud Gudes. Exploiting Local Similarity for Efficient Indexing of Paths in Graph Structured Data. IEEE Int'l Conf Data Engg., 2002.

P. Shenoy, J. Haritsa, S. Sudarshan, G. Bhalotia, M. Bawa, D. Shah. Turbo-Charging Vertical Mining of Large Databases. ACM SIGMOD Int'l Conf. on management of data, 2000.

PROFESSIONAL SERVICE

Reviewer for SIGMOD, VLDB, NIPS (2003), NIPS (2004), NIPS, CHI (2006), NIPS (2007), NIPS, CHI, UIST (2008), NIPS, CHI, AISTATS, UIST (2009) and for the IEEE journals on Biomedical Engineering (TBME) and Neural Systems & Rehab Engg (TNSRE).

REFERENCES

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