Pavan Ramkumar

http://klab.smpp.northwestern.edu/wiki/index.php5/Pavan_Ramkumar
pavan.ramkumar@northwestern.edu
github.com/pavanramkumar
312-608-7178
6171 N Sheridan Road, Apt 801
Chicago, IL, 60660

Education

Aalto University, Finland
PhD in Information and Computer Science **2012**
Thesis: Advances in modeling and characterization of human neuromagnetic oscillations.
Advisors: Riitta Hari and Aapo Hyvärinen

Helsinki University of Technology, Finland
M.Sc. Tech. in Bioinformatics **2009**
Thesis: Modeling the dynamics of human neuromagnetic brain rhythms
Advisors: Riitta Hari and Lauri Parkkonen

Indian Institute of Technology Guwahati, India
B. Tech. Electronics and Communication Engineering **2006**
Thesis: EEG Signal Acquisition, De-Noising and Classification for Biometric Applications

Experience

Northwestern University, USA
Research Associate **Sept 2012 — present**
Advisors: Konrad Kording, Mark Segraves, Lee Miller

Focus areas

- Primate psychophysics and electrophysiology for understanding decision making in visual, oculomotor and motor systems
- Analysis and modeling of behavioral and neural data in the context of natural scene perception, eye movements in naturalistic vision, reaching behavior, and motor sequence learning

Contributions

- Lead data analysis efforts as senior postdoc in a team of 4 scientists for one NIH-R-01-funded project studying FEF in natural scene search with Mark Segraves
- Lead a collaboration with Matt Smith, U Pitt, on naturalistic color vision in V4
- Lead a collaboration with Rob Turner, U Pitt, and Scott Grafton, UCSB on motor sequence learning and chunking

- Active in experimental design, data analysis, and data interpretation for a second NIH-R-01-funded project studying uncertainty representation in M1 and PMd, with Lee Miller
- Develop high-performance computing routines for neural data analysis on local computing cluster
- One first-author published journal article
- Four first-author and two co-author publications under review or in preparation

Aalto University, Finland
Doctoral Candidate **Aug 2006 – Aug 2012**

Focus areas

- Signal processing and inverse modeling of MEG signals
- Modeling and analysis of oscillatory activity during resting state
- Investigations in low-level vision and natural scene perception using multivariate decoding

Contributions

- Primary graduate student in a new collaboration between a statistical data analysis and a neuroimaging group
- Active contributor of code and technical comments to MEG mailing lists
- Trained undergraduate and masters students to produce published research originally proposed by me
- Initiated and led an international collaboration that led to successful publications
- Seven journal publications (four first-author)

Technische Universität Graz, Austria
Summer Intern **May – July 2005**

Dynamic Stereo-Visual Servoing of a MITSUBISHI 6-DOF Robot

Indian Institute of Science Bangalore, India
Summer Intern **May – July 2004**

Stereo Camera Calibration and Hand Eye Co-ordination of a RHINO XR-3 Robot

Publications

Journals

In Preparation

[A15] **Ramkumar P**, Fernandes HL, Smith MA, Körding KP. 2015. Hue tuning during active vision in natural scenes. In Preparation

[A14] Dekleva BM, **Ramkumar P**, Wanda PA, Körding KP, Miller LE. 2015. The effects of target uncertainty on motor cortex. In Preparation

Under Review/ Revision

[A13] **Ramkumar P**, Hansen BC, Pannasch S, Loschky LC. 2015. A high-resolution neural portrait of natural scene processing. In Review

[A12] **Ramkumar P**, Cooler S, Dekleva BM, Miller EL, Körding KP. 2015. A reinforcement signal in motor and premotor cortices. In Review

[A11] Glaser JI*, Wood DW*, Lawlor PN, **Ramkumar P**, Körding KP, Segraves MA. 2015. Neural differences between exploratory and exploitative saccades. In Review

[A10] **Ramkumar P**, Acuna DE, Berniker M, Grafton S, Turner RS, Körding KP. 2015. Movement chunking as locally optimal control. In Review

[A9] **Ramkumar P***, Lawlor PN*, Wood DW, Glaser JI, Segraves MA, Körding KP. 2015. Task-relevant features predict gaze behavior but not neural activity in FEF during natural scene search. In Review

Published

[A8] **Ramkumar P**, Fernandes HL, Körding KP, Segraves MA. 2015. Modeling peripheral visual acuity enables discovery of gaze strategies at multiple time scales during natural scene search. **Journal of Vision** 15: 9.

[A7] **Ramkumar P**, Parkkonen L, Hyvärinen A. 2014. Group-level spatial independent component analysis of Fourier envelopes of resting-state MEG data. **Neuroimage** 86: 480–491.

[A6] **Ramkumar P**, Jas M, Pannasch S, Parkkonen L, Hari R. 2013. Feature-specific information processing precedes concerted activation in human visual cortex. **J Neurosci** 33: 7691–7699.

[A5] Hyvärinen A, **Ramkumar P**. 2013. Testing independent component patterns by inter-subject or inter-session consistency. **Front Hum Neurosci**, 7 (94).

[A4] **Ramkumar P**, Parkkonen L, Hari R, Hyvärinen A. 2012. Characterization of neuromagnetic brain rhythms over time scales of minutes using spatial independent component analysis. **Hum Brain Mapp**, 33: 1648–1662.

[A3] Hyvärinen A, **Ramkumar P**, Parkkonen L, Hari R. 2010. Independent component analysis of short-time Fourier transforms for spontaneous EEG/MEG analysis. **Neuroimage**, 49: 257–271.

[A2] **Ramkumar P**, Parkkonen L, Hari R. 2010. Oscillatory Response Function: Towards a parametric model of rhythmic brain activity. **Hum Brain Mapp**, 31: 820–

834.

[A1] Malinen S, Vartiainen N, Hlushchuk Y, Koskinen M, **Ramkumar P**, Forss N, Kalso E, Hari R. 2010. Aberrant spatiotemporal resting-state brain activation in patients with chronic pain. **Proc Natl Acad Sci USA**, 107: 6493–6497.

Conference Publications

[P5] **Ramkumar P**, Hansen BC, Lee A, Lanphier S, Pannasch S, Loschky LC. 2014. A high-resolution neural portrait of natural scene processing. Computer Vision and Pattern Recognition (**CVPR**) — Scene Understanding Workshop.

[P4] **Ramkumar P**, Pannasch S, Hansen BC, Larson AM, Loschky LC. 2011. How does the brain represent visual scenes? A neuromagnetic scene categorization study. Neural Information Processing Systems (**NIPS**) — Workshop on Machine Learning and Interpretation in Neuroimaging.

[P3] Klami A, **Ramkumar P**, Virtanen S, Parkkonen L, Hari R, Kaski S. ICANN/PASCAL2 challenge: MEG mind reading—overview and results. 2011. Proceedings of the International Conference on Artificial Neural Networks (**ICANN**), June 2011, Helsinki.

[P2] **Ramkumar P**, Hyvärinen A, Parkkonen L, Hari R. Characterization of spontaneous neuromagnetic brain rhythms using independent component analysis of short-time Fourier transforms. 2010. Proceedings of the 17th International Conference on Biomagnetism (**BIOMAG**), April 2010, Dubrovnik.

[P1] Singhal GK*, **Ramkumar P***. Person identification using evoked potentials and peak matching. 2007. IEEE Biometrics Symposium (**BSYM**), Sept 2007, Baltimore.

Conference Abstracts

[C26] **Ramkumar P**, Cooler S, Dekleva BM, Miller EL, Körding KP. 2015. A reinforcement signal in motor and premotor cortices. Society for Neuroscience, October 2015, Chicago, USA.

[C25] **Ramkumar P**, Hansen BC, Pannasch S, Loskhy LC. A rapid whole-brain neural portrait of scene category inference. Vision Science Society, May 2015, St. Pete's beach, Florida, USA.

[C24] Glaser JI, Lawlor PN, Wood DK, **Ramkumar P**, Caddigan S, Drapekin J, Frick B, Qin B, Körding KP, Segraves MA. The frontal eye field reflects task demands in natural scenes. Society for Neuroscience, November 2014, Washington DC, USA.

[C23] Wood DK, **Ramkumar P**, Glaser JI, Lawlor PN, Körding KP, Segraves MA. How do frontal eye field neurons ignore distractors while selecting target-relevant features in natural scenes? Society for Neuroscience, November 2014, Washington DC, USA.

[C22] **Ramkumar P**, Fernandes HL, Smith MA, Körding KP. Shift and gain of color-tuning in V4 neurons is modulated by hue distribution in natural scenes. Society for Neuroscience, November 2014, Washington DC, USA.

[C21] **Ramkumar P**, Acuna DE, Berniker M, Grafton S, Turner RS, Körding KP. Movement chunking as locally optimal control. Translational and Computational Motor Control, November 2014, Washington DC, USA.

[C20] **Ramkumar P**, Dekleva B, Wanda P, Fernandes HL, Miller L, Körding KP. Uncertainty modulates timing of neural interaction in PMd during reach planning. Computational Systems Neuroscience, February 2014, Salt Lake City, Utah, USA.

[C19] **Ramkumar P**, Fernandes HL, Segraves MA, Körding KP. Target relevance modulated primate gaze behavior during natural scene search. Vision Science Society, May 2013, Naples, Florida, USA.

[C18] **Ramkumar P**, Parkkonen L, Hyvärinen A. Independent component analysis of Fourier energies: characterizing long-range cortico-cortical interactions in magnetoencephalography (MEG) data. Society for Neuroscience, November 2011, Washington DC, USA.

[C17] Hyvärinen A, **Ramkumar P**, Hari R. Advances in analysis of spontaneous EEG/MEG activity by independent component analysis. 29th International Congress on Clinical Neurophysiology, October 2010, Kobe, Japan.

[C16] **Ramkumar P**, Hyvärinen A, Parkkonen L, Hari R. Characterization of spontaneous neuromagnetic brain rhythms using spatial independent component analysis of short-time Fourier transforms. International Congress on Default Mode Network, June 2010, Barcelona, Spain.

[C15] Yokosawa K, Pamilo S, Hirvenkari L, **Ramkumar P**, Pihko E, Hari R. Activation of auditory cortex by anticipating and hearing emotional sounds: an MEG study. 16th Annual Meeting of the Organization for Human Brain Mapping, June 2010, Barcelona, Spain.

[C14] Nangini C, **Ramkumar P**, Hari R. SII neurons can phase-lock to trains of bilateral 4-Hz tactile stimuli. 16th Annual Meeting of the Organization for Human Brain Mapping, June 2010, Barcelona, Spain.

[C13] Mudigonda M, **Ramkumar P**, Zhu D, Stockman G, Jin R. Multivoxel pattern analysis identifies brain regions that discriminate indoor and outdoor scenes. 16th Annual

Meeting of the Organization for Human Brain Mapping, June 2010, Barcelona, Spain.

[C12] **Ramkumar P**, Malinen S, Vartiainen N, Hlushchuk Y, Forss N, Kalso E, Hari R. Hub maps reveal reduced resting-state connectivity of insular cortex in patients with chronic pain. 16th Annual Meeting of the Organization for Human Brain Mapping, June 2010, Barcelona, Spain.

[C11] Hyvärinen A, **Ramkumar P**, Hari R. Selecting independent components by testing inter-subject reproducibility. 16th Annual Meeting of the Organization for Human Brain Mapping, June 2010, Barcelona, Spain.

[C10] Hyvärinen A, Zhang K, **Ramkumar P**, Hari R. Analyzing statistical dependencies of MEG source envelopes. 17th International Conference on Biomagnetism, April 2010, Dubrovnik, Croatia.

[C9] **Ramkumar P**, Hyvärinen A, Parkkonen L, Hari R. Separating independent components of neuromagnetic brain rhythms by combining spatial and spectral sparseness. 17th International Conference on Biomagnetism, April 2010, Dubrovnik, Croatia.

[C8] **Ramkumar P**, Parkkonen L. Characterization of the temporal structure of neuromagnetic rhythms using clustering and self-organizing maps. 2nd INCF Congress on Neuroinformatics, September 2009, Pilzen, Czech Republic.

[C7] Parkkonen L, **Ramkumar P**, Hari R. A descriptive model of the dynamics of rhythmic brain activity. 1st INCF Congress on Neuroinformatics, September 2008, Stockholm, Sweden.

[C6] Hyvärinen A, Parkkonen L, **Ramkumar P**, Hari R. A new method for unsupervised analysis of spontaneous MEG/EEG data: Combination of projection pursuit and parallel factor analysis. 1st INCF Congress on Neuroinformatics, September 2008, Stockholm, Sweden.

[C5] Hyvärinen A, Parkkonen L, **Ramkumar P**, Hari R. Finding 'interesting' frequency bands in MEG using an unsupervised learning approach. 16th International Conference on Biomagnetism, August 2008, Sapporo, Japan.

[C4] **Ramkumar P**, Parkkonen L, Hari R. Oscillatory Response Functions: Towards a parametric model of rhythmic activity. PENS Spring School: Models in Neuroscience, April 2008, St. Petersburg, Russia.

[C3] **Ramkumar P**, Parkkonen L, He B, Raichle M, Hämäläinen M, Hari R. Identification of stimulus related and intrinsic networks by spatial independent component analysis of MEG signals. Society for Neuroscience, November 2007, San Diego, USA.

[C2] **Ramkumar P**, Parkkonen L, Hari R. Independent component analysis of neuromagnetic data reveals extrinsic and intrinsic cortical networks during natural stimulation. Nordic Neuroinformatics meeting, October 2007, Helsinki, Finland.

[C1] **Ramkumar P**, Singhal GK, Dandapat S. EEG Correlates of highly cognitive mental tasks for closed-set biometric authentication. International Biometric Conference, July 2006, Montreal, Canada.

Book Chapters

[B2] Creating a Flourishing Innovation Climate. In Bitbang: Energising Innovation, Innovating Energy. 2011. Eds. Yrjö Neuvo and Sami Ylonen.

[B1] Smart Grids: Power to the people, power from the people. In Bitbang: Energising Innovation, Innovating Energy. 2011. Eds. Yrjö Neuvo and Sami Ylonen.

Invited Talks

[T11] **Invited Colloquium Speaker**. February 2015. Department of Psychological Sciences, Kansas State University, Manhattan, KS. Host: Dr. Lester Loschky.

[T10] **Contributed Conference Talk**. November 2014. Translational and Computational Motor Control, Washington DC.

[T9] **Invited Department Visit**. August 2013. Department of Neuroscience, Indian Institute of Science, Bangalore, India. Host: Dr. Supratim Ray.

[T8] **Invited Group Visit**. June 2013. Neurospin, Paris. Host: Dr. Alex Gramfort.

[T7] **Invited Group Visit**. June 2013. Group for Neural Theory, Paris. Host: Dr. Sophie Deneve.

[T6] **Postdoctoral Candidate**. November 2011. Center for Neural Basis of Cognition, Pittsburgh, PA. Host: Dr. Avniel Ghuman.

[T5] **Postdoctoral Candidate**. November 2011. Sensorimotor Performance Program, Rehabilitation Institute of Chicago. Host: Dr. Konrad Kording.

[T4] **Conference Poster Spotlight**. October 2010. International Neuroinformatics Coordination Facility, Stockholm.

[T3] **Invited Department Visit**. December 2009. Indira Gandhi Center for Atomic Research, Chennai. Host: Dr. M.P.Janwadkar

[T2] **Invited Seminar**. February 2009. BIOMAG Lab, University of Helsinki.

[T1] **Invited Motivational Speaker for high school science class**. December 2008. Symbiosis High School, Pune.

Awards and Honors

- Finnish Graduate School of Neuroscience **Academic Fellowship**: competitive funding for graduate studies
- Aalto University **Doctoral Scholarship** 2011 and 2012 (awarded for thesis proposal within two years and a successful defense within 4 years and under the age of 30)
- Represented Finland at the annual **Lindau Meeting of Nobel Laureates** in Physiology and Medicine 2011, held in Lindau, Germany. **Acceptance rate under 5%. Appointment by nomination only**.
- **Travel and best abstract awards** from Human Brain Mapping (**HBM**) from Biomagnetism International Conference (**BIOMAG**) and International Neuroinformatics Coordination Facility (**INCF**)
- **Visiting Research Fellowship**, Centre of International Mobility, Finland: proposal-based grant funding for visiting researchers
- **Indian Academy of Sciences** (IAS) Student **Summer Fellowship** Programme 2004
- **Institute Merit Scholarship** (awarded for securing highest departmental GPA 2002–2003), IIT Guwahati
- **Gold Medalist** in the **Indian National Chemistry Olympiad**, 2002 (among 28 in India after 4 stages of rigorous theoretical and practical examinations)

Referee Experience

- **Editorial board member** of Frontiers in Brain Imaging Methods (2012 onwards).
- **Reviewer for journals** including Neuroimage (2011–present), Nature Scientific Reports (2012–present), Frontiers in Brain Imaging Methods (2013–present), Decision (2013–present), PLoS One (2013–present), European Journal of Neuroscience (2013–present), Biological Cybernetics (2014–present), Philosophical Transactions of the Royal Society B (2015–present).
- **Reviewer of abstracts** for the Organization of Human Brain Mapping Annual Meeting 2010.
- Co-organized and reviewed contest submissions for an **MEG data analysis contest**: http://www.cis.hut.fi/icann11/mindreading.php

Leadership Experience

Academic

- 2015. Mentor of a masters thesis student, Karim Farrag, working on experimental design and modeling of gaze behavior in natural scene search.

- 2015. Instructor of a visiting undergraduate student, Abhishek Ravichandran, working various neural data analyses from population recordings in the motor cortex.
- 2015. Instructed and provided tools for a rotation student, Sam Cooler, working on investigating reward coding the motor cortex. I am first author on a paper resulting from this work, which is currently under review in Current Biology.
- 2014. Instructor of a first year PhD student, Heidi Jiang, for one term, working on testing computational models of decision making.
- 2013. Instructor of a first year PhD student, James Ellis, for one term working on data analysis of neurons in visual area V4.
- 2010–2012. Served as an instructor for a machine-learning and data mining masters thesis, by Kranthi Kumar Nallamothu, on eye-gaze-based classification of visual stimuli.
- 2011. Served as a mentor and instructor to an international summer student, Mainak Jas. I proposed the summer project and was responsible for hiring and supervising his work, which resulted in a peer-reviewed publication in the Journal of Neuroscience.
- 2010–2011. Mentored and edited interdisciplinary teams of PhD students working on book chapters related to entrepreneurship, services, energy, and innovation: http://mide.aalto.fi/en/BitBang10-11. Co-organized an industrial visit from Helsinki to Bangalore.

Extracurricular

- Vice-president of the founding board of a university-wide organization called **Aalto Social Impact**, which strives to support social entrepreneurship and promote social consciousness. I participated in building the vision, setting strategic directions, putting together a team of international board members, as well as organizing various events: http://www.aaltosi.org
- Founded and ran a monthly event series where I screened talks from leading multidisciplinary conferences such as **TED** and moderated free discussion to a public audience with the intention of increasing curiosity towards great ideas. Organized **TEDx** meetings are part of the series.