Satrajit S. Ghosh, Ph.D.

CURRICULUM VITAE

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Profile

Strong background in neuroimaging, neuro-computational modeling of speech, machine learning, signal processing and software engineering.

Professional Experience

2007 -   **Research Scientist**
Speech Communication Group, Research Laboratory of Electronics
Massachusetts Institute of Technology

Improve analysis of structural and functional neuroimaging data. Advise students on signal processing and functional imaging and in improving their experimental designs, analysis methods, and interpretation of their results. Lead a multi-institution collaboration to create an improved platform for neuroimaging data analysis and visualization.

2008 -   **Instructor**
Program in Speech and Hearing Biosciences and Technology
Harvard-MIT Division of Health Sciences and Technology
Instructor: Speech Communication (MIT: Course 6.541/HST)
Co-Instructor: Acoustics of Speech and Hearing (MIT: Course 6.551/HST)

2010 -   **Standards for Datasharing: Neuroimaging Task Force Member**
International Neuroinformatics Coordinating Facility

Neuroscience data, particularly those in neuroinformatics related areas such as neuroimaging and electrophysiology, are associated with a rich set of descriptive information often called metadata. The goal of this task force is to develop generic standards and tools to facilitate the recording, sharing, and reporting of

neuroimaging metadata. It is expected that these efforts will greatly improve upon current practices for archiving and sharing neuroscience data.

2004 - 2006   **Postdoctoral Associate**
Speech Communication Group, Research Laboratory of Electronics
Massachusetts Institute of Technology

Designed and executed psychophysical and functional brain imaging experiments aimed at understanding human speech perception and production. Analyzed the data using speech signal processing and statistical approaches. Wrote real-time digital signal processing code for speech processing. Synthesized artificial speech and created interactive interfaces for running experiments.

2005 - 2010   **Research Fellow**
Department of Cognitive and Neural Systems
Boston University, Boston, MA

Consulted on the hardware and software used for collecting and analyzing data from brain imaging experiments. Advised post-docs and graduate students on their experimental designs, analysis methods, and interpretation of their results.

1999 - 2004   **Graduate Research Assistant**
Speech Lab, Department of Cognitive and Neural Systems
Boston University, Boston, MA

1999 - 2000   **Teaching Fellow**
Department of Cognitive and Neural Systems
Boston University, Boston, MA

Course: "Neural models of Speech and Hearing."

1997 - 1998   **Software Engineer**
Media for Learning Group, Kent Ridge Digital Labs
(now Institute for Infocomm Research), Singapore

Worked with a team of people to create real-time, parametric sound effects and interactive music generation software. Developed visual interfaces, interactive music algorithms and software libraries for scheduling sound events and interfacing with hardware.

1996 - 1997   **Teaching Assistant**
Department of Computer Science
National University of Singapore, Singapore

Education

2004   **Ph.D.** in **Cognitive and Neural Systems**, **Boston University**
        Thesis: "Understanding cortical and cerebellar contributions to
                speech production through modeling and functional imaging"
        Advisor: Prof. Frank Guenther

1997   **B.S. (Honors)** in **Computer Science**, **National University of Singapore**
        Thesis: "Sound generation using the Chua oscillator with an adaptive
                neural network model for inverse parameter mapping"
        Advisor: Prof. Lonce Wyse

Grants

2008-2010   R03 (NIBIB)   **Principal Investigator**
             "Dissemination of software for artifact detection
              and functional analysis of parcellated imaging data"

Other professional experience

Review Editor
        Frontiers in Neuroscience Methods
Ad-hoc reviewer
Grants: National Science Foundation, USA
             National Medical Research Council, Singapore
Journals: Biological Psychiatry
             Brain and Language
             Current Biology
             Human Brain Mapping
             NeuroImage
             Journal of Neuroscience
             Journal of Speech, Language and Hearing Research

Honors and Awards Information

2000   Graduate Teaching Fellow Award, Boston University
1998   Presidential University Graduate Fellowship, Boston University
1995   Dean's List, School of Science, National University of Singapore
1994-97   Singapore Airlines/Neptune Orient Lines Undergraduate Scholarship
1994   Ranked 237th (of 100000+) in Indian Institute of Technology (IIT)
          All-India Exam
1993   Selected to the Indian National Mathematics Olympiad

Invited Talks

"Region of interest analysis of functional Magnetic Resonance Imaging data"
- Gabrieli Lab, McGovern Institute for Brain Research, MIT (July, 2007)
- New York State Psychiatric Institute, Columbia University, NY (July, 2007)
- Singapore General Hospital (November, 2007)

"Exploring speech motor control through computational modeling and neuroimaging"
- Center for Life Sciences, National University of Singapore (November, 2007)

"Nipype: Opensource platform for unified and replicable interaction with existing neuroimaging tools"
- NITRC Grantee meeting, San Francisco, CA (June, 2009)
- Brigham and Women's Hospital (December, 2009)
- BrainMap, MGH/MIT (February, 2010)
- Scientific Python Conference in India (December, 2010)

"Using high-resolution fMRI to identify individual-specific speech motor regions"
- Surgical planning laboratory, Brigham and Women's Hospital (February, 2010)

Professional Memberships

International Society for Magnetic Resonance in Medicine
Organization for Human Brain Mapping
Society for Neuroscience

Software developed

2008-	Nipype: A python framework neuroimaging analysis workflows
2004-2005	Online noise suppression for MRI patient microphone input
2002-2003	Interactive parcellation of brain MRI images
1999-2000	Carotid artery diameter estimation using ultrasound images
1997-1998	Interactive sound effects and music generation

Provisional Patents

2007	Online noise suppression software for Magnetic Resonance Imaging
2007	Bidirectional noise suppressing communication setup for Magnetic Resonance Imaging

Publications

Papers in Refereed Journals and Book Chapters

1. Nieto-Castanon, A., **Ghosh, S.S.**, Tourville, J.A. and Guenther, F.H. (2003) Region of interest based analysis of functional imaging data. Neuroimage. 19(4): 1303-16.
2. Max, L., Guenther, F.H., Gracco, V.L., **Ghosh, S.S.** and Wallace, M.E. (2004) Unstable or insufficiently activated internal models and feedback-biased motor control as sources of dysfluency: A theoretical model of stuttering. Contemporary Issues in Communication Science and Disorders. 31.
3. Guenther, F.H., Nieto-Castanon, A., **Ghosh, S.S.** and Tourville, J.A. (2004) Representation of sound categories in auditory cortical maps. Journal of Speech, Language, and Hearing Research. 47(1): 46-57.
4. Klein, A., Mensh, B., **Ghosh, S.S.**, Tourville, J. and Hirsch, J. (2005) Mindboggle: Automated brain labeling with multiple atlases. BMC Medical Imaging, 5:7.
5. Guenther, F.H., **Ghosh, S.S.**, Nieto-Castanon, A. and Tourville, J.A. (2006) A neural model of speech production. In: J. Harrington & M. Tabain (eds.), Speech Production: Models, Phonetic Processes, and Techniques. London: Psychology Press.
6. Guenther, F.H., **Ghosh, S.S.** and Tourville, J.A. (2006) Neural modeling and imaging of the cortical interactions underlying syllable production. Brain and Language. 96(3):280-301.
7. **Ghosh, S.S.**, Tourville, J.A. and Guenther, F.H. (2008) A neuroimaging study of premotor lateralization and cerebellar involvement in the production of phonemes and syllables. Journal of Speech, Language and Hearing Research. 51(5):1183-202.
8. Klein, A., **Ghosh, S.S.**, Avants, B., Yeo, B.T.T, Fischl, B., Ardekani, B., Gee, J.C., Mann, J.J., Parsey, R.V. (2010). Evaluation of volume-based and surface-based brain image registration methods. Neuroimage.
9. **Ghosh, S.S.**, Kakunoori, S., Augustinack, J., Nieto-Castanon, A., Kovelman, I., Gaab, N., Christodoulou, J.A., Triantafyllou, C., Gabrieli, J.D., Fischl, B. (2010). Evaluating the Validity of Volume-Based and Surface-Based Brain Image Registration for Developmental Cognitive Neuroscience Studies in Children 4-to-11 Years of Age. Neuroimage.
10. Cai, S., **Ghosh, S.**, Guenther, F., Perkell, J. (2010). Adaptive Auditory Feedback Control of the Production of Formant Trajectories in the Mandarin Triphthong /iau/ and its Pattern of Generalization. Journal of the Acoustical Society of America.
11. Hinds, O., **Ghosh, S.**, Thompson, T.W., Yoo, J.J., Whitfield-Gabrieli, S., Triantafyllou, C., Gabrieli, J.D. (2010) Computing moment to moment BOLD activation for real-time neurofeedback. Neuroimage
12. **Ghosh, S.**, Matthies, M., Maas, E., Hanson, A., Tiede, M., Menard, L., Guenther, F., Lane, H., Perkell, J. (2010) An investigation of the relation between sibilant production and somatosensory and auditory acuity. Journal of the Acoustical Society of America
13. Brunner, J., **Ghosh, S.**, Hoole, P., Matthies, M., Tiede, M., & Perkell, J. (2010) The influence of auditory acuity on acoustic variability and the use of motor equivalence during adaptation to a perturbation. Journal of Speech, Language and Hearing Research

Papers in Refereed Proceedings

1. Guenther, F.H., Nieto-Castanon, A., Tourville, J.A. and **Ghosh, S.S.** (2001) The effects of categorization training on auditory perception and cortical representations. Proceedings of the Speech Recognition as Pattern Classification (SPRAAC) Workshop, Nijmegen, The Netherlands.
2. Guenther, F.H. and **Ghosh, S.S.** (2003) A model of cortical and cerebellar function in speech. Proceedings of the XVth International Congress of Phonetic Sciences (pp. 169-173). Barcelona, Spain: 15th ICPhS Organizing Committee.
3. Guenther, F.H., **Ghosh, S.S.** and Nieto-Castanon, A. (2003) A neural model of speech production. Proceedings of the 6th International Seminar on Speech Production. Sydney, Australia
4. Tiede, M., Shattuck-Hufnagel, S., Johnson, B., **Ghosh, S.**, Matthies, M., Zandipour, M. and Perkell, J. (2007) Gestural phasing in /kt/ sequences contrasting within and cross word contexts. Proceedings of the XVIth International Congress of Phonetic Sciences. Saarbrücken, Germany: 16th ICPhS Organizing Committee.
5. Balci, S.K., Sabuncu, M.R., Yoo, J, **Ghosh, S.S.**, Whitefield-Gabrieli, S., Gabrieli, J.D.E., Golland, P. (2008) Prediction of Successful Memory Encoding from fMRI Data. In Proc. MICCAI Workshop on Analysis of Functional Medical Images, 97-104.
6. Cai, S, Boucek, M, **Ghosh, S.S.**, Guenther, F.H., Perkell, J.S. (2008) A System for Online Dynamic Perturbation of Formant Trajectories and Results from Perturbations of the Mandarin Triphthong /iau/. International Seminar in Speech Production, Strassbourg, France.
7. Perkell, J.S., Lane, H., **Ghosh, S.S.**, Matthies, M.L., Tiede, M., Guenther, F., Ménard, L. (2008) Mechanisms of Vowel Production: Auditory Goals and Speaker Acuity. International Seminar in Speech Production, Strassbourg, France.

Refereed abstracts

1. **Ghosh, S.S.**, Nieto-Castanon, A., Tourville, J.A. and Guenther, F.H. (2001) ROI-based analysis of fMRI data incorporating individual differences in brain anatomy. NeuroImage, Vol 13, Issue 6, Supplement 1, June, Page 125.
2. **Ghosh, S.S.**, Bohland, J. and Guenther, F.H. (2003) Comparisons of brain regions involved in overt production of elementary phonetic units. Neuroimage, Presented at the 9th Annual Meeting of the Organization for Human Brain Mapping, New York, USA. 19(2): S57.
3. Purdon, P.L., **Ghosh, S.S.**, Brown, E.N. and Bonmassar, G. (2005) A high-fidelity headphone system for simultaneous EEG/fMRI experiments. Proceedings of the International Society for Magnetic Resonance in Medicine Meeting, Florida, USA.
4. Tourville, J.A., Guenther, F.H., **Ghosh, S.S.**, Reilly, K.J. and Bohland, J. (2005) Effects of acoustic and articulatory perturbation on cortical activity during speech production. Presented at the 11th Annual Meeting of the Organization for Human Brain Mapping, June 12-16, 2005, Toronto, Ontario, Canada. Available on CD-Rom in NeuroImage, Vol. 26, No.1.
5. **Ghosh, S.S.** and Bohland, J. (2005) A speech recording setup for fMRI with online reduction of scanner noise. Presented at the 11th Annual Meeting of the Organization for Human

Brain Mapping, June 12-16, 2005, Toronto, Ontario, Canada. Available on CD-Rom in NeuroImage, Vol. 26, No.1.

6. Dickerson, B.C., Miller, S. and **Ghosh, S.S.** (2006) An fMRI system for studying overt free recall: Preliminary data demonstrates hippocampal activation. Presented at the 12th Annual Meeting of the Organization for Human Brain Mapping, June 11-15, 2006, Florence, Italy. NeuroImage, Vol. 31, Supplement 1, Page S163.

7. Robin, D.A., Guenther, F.H., Narayana, S., Jacks, A., Tourville, J., Ramage, A.E., Lancaster, J.L., Franklin, C., **Ghosh, S.**, Fox, P.T. (2008) A Transcranial Magnetic Stimulation Virtual Lesion Study of Speech. Proceedings of the conference on Speech Motor Control. Monterey, California, USA.

8. Perkell, J.S., **Ghosh, S.S.**, Guenther, F.H., Lane, H., Mathies, M.L., Menard, L., Tiede, M.K. (2008) Mechanisms of Vowel Production: Auditory Goals and Speaker Acuity. Proceedings of the conference on Speech Motor Control. Monterey, California, USA.

9. Hinds, O., Gabrieli, S., Ofen, N., Yoo, J., **Ghosh, S.**, Lala, N., Willingham, D., Triantafyllou, C., Gabrieli, J. (2008) Transitions of task-related brain activation during acquisition of a novel perceptual-motor mapping. Presented at the 14th Annual Meeting of the Organization for Human Brain Mapping, Melbourne, Australia.

10. **Ghosh, S.S.**, Hamm, M., Jahns, K., Triantafyllou, C. (2008) Using High Resolution fMRI to identify individual-specific speech motor regions. XVIth conference of the International Society for Magnetic Resonance in Medicine, Toronto, Canada.

11. Kovelman, I., **Ghosh, S.S.**, O'Loughlin, P., Ostrovskaya, I., Perrachione, T. K., Lymberis, J., Norton E. S., Cosman, S., Wexler, K., Gabrieli J. D. E. (2009) Optional Infinitive: Evidence of How Adult Brain Processes Grammatical Errors that are Typical and Atypical of Childhood Language Acquisition. Cognitive Neuroscience Meeting, San Francisco, California.

12. Thompson, T.W., Hinds, O., **Ghosh, S.**, Lala, N., Triantafyllou, C., Whitfield-Gabrieli, S., Gabrieli, J. (2009). Training Selective Auditory Attention with Real-Time fMRI Feedback, NeuroImage, Volume 47, Supplement 1, Organization for Human Brain Mapping 2009 Annual Meeting.

13. Klein, A., **Ghosh, S.S.**, Parsey, R.V. (2009) An evaluation of volume- and surface-based nonlinear registration of human brain MRI data, NeuroImage, Volume 47, Supplement 1, Organization for Human Brain Mapping 2009 Annual Meeting.

14. **Ghosh, S.S.**, Whitfield-Gabrieli, S., Nieto-Castanon, A. (2009). A Python-based software package for pipelined, batch analysis of fMRI data, NeuroImage, Volume 47, Supplement 1, Organization for Human Brain Mapping 2009 Annual Meeting.

15. **Ghosh, S.S.**, Kovelman, I., Lymberis, J., Gabrieli, J.D. (2009) Incorporating hemodynamic response functions to improve analysis models for sparse-acquisition experiments, NeuroImage, Volume 47, Supplement 1, Organization for Human Brain Mapping 2009 Annual Meeting.

16. **Ghosh, S.**, Burns, C., Clark, D., Gorgolewski, K., Halchenko, Y., Madison, C., Tungaraza R., Millman J. (2010). Nipype: Opensource platform for unified and replicable interaction with existing neuroimaging tools. 16th Annual Meeting of the Organization for Human Brain Mapping

17. **Ghosh, S.**, Granger, B., Perez, F. (2010). Distributed Neuroimaging Analysis with Nipype and IPython. 16th Annual Meeting of the Organization for Human Brain Mapping.

Other conferences

1. Guenther, F.H., Nieto-Castanon, A., Tourville, J.A. and **Ghosh, S.S.** (2000) The representation of prototypical and non-prototypical vowels in peri-sylvian cortical areas. Proceedings of the Society for Neuroscience Meeting, New Orleans, USA.
2. Tourville, J.A., Guenther, F.H., **Ghosh, S.S.** and Bohland, J.W. (2004) Effects of jaw perturbation on cortical activity during speech production. J. Acoust. Soc. Am. 116, 2631.
3. Perkell, J., Zandipour, M., **Ghosh, S.**, Menard, L., Lane, H., Tiede, M. and Guenther, F. (2006) Variation in vowel production. J. Acoust. Soc. Am. 120(5), 3293-3294.
4. Perkell, J.S., Matthies, M.L., **Ghosh, S.S.**, Maas, E., Hanson, A., Guenther, F.H., Lane, H., Ménard, L., Tiede, M. (2008) Auditory and somatosensory goals for sibilants. J. Acoust. Soc. Am. 123(5):3459.
5. Perrachione, T., Kovelman, I, Ostrovskaya, I., Lymberis, J., O'Loughlin, P., Norton, E., **Ghosh, S.S.**, Gabrieli, J. (2009) Temporal and prefrontal cortical contributions to phonological working memory for words and pseudowords. Proceedings of the Society for Neuroscience Meeting, Chicago, USA.
6. Ostrovskaya, I., **Ghosh, S.S.**, Kovelman, I, Lymberis, J., O'Loughlin, P., Perrachione, T., Norton, E., Wexler, K., Gabrieli, J. (2009) Persistent markers of developmentally typical syntax errors in adult behavior and neurophysiology. Proceedings of the Society for Neuroscience Meeting, Chicago, USA.
7. Waskom, M.L., Polli, F.E., **Ghosh, S.S.**, Dutra, S.J., Dillon, D.G., Holmes, A.J., Iosifesco, D.V., Fava, M., Gabrieli, J. D. E., Pizzagalli, D. A. (2010) Multivariate pattern analyses reveal morphological abnormalities in major depressive disorder. Proceedings of the Society for Neuroscience Meeting, San Diego, USA.
8. Thompson, T., Hinds, O., **Ghosh, S.**, Pollard, K, Triantafullyoi, C., Whitfield-Gabrieli, S., Gabrieli, J.D.E. (2010) Training selective auditory attention with real-time fMRI feedback. Proceedings of the Society for Neuroscience Meeting, San Diego, USA.