Ipshita Bhattacharya

Graduate Research Assistant
Department of Electrical & Computer Engineering
University of Iowa
Tel No: 214-636-9172

ipshita.sb.bhattacharya@gmail.com
ipshita-bhattacharya@uiowa.edu

Research Expertise

Signal and Image Processing, Compressed Sensing, Data driven model based learning, Machine Learning, Magnetic Resonance Image Reconstruction, Magnetic Resonance Spectroscopic Imaging, Multi-dimensional Spectroscopy, Metabolic Imaging, Pulse Sequence Design.

Research Highlights

- ◇ Currently developing a structured low-rank recovery algorithm for de-interleaving and denoising of echo-planar spectroscopic data. This would enable the simultaneous denoising and removal of spurious peaks appearing due to interleaving of high resolution EPSI data.
- ◇ Developed a structured low-rank recovery algorithm to accelerate and denoise multi-dimensional spectroscopic data. This method was applied to two-dimensional infrared spectroscopic data and attained an acceleration factor of 8, being the first method to retain lineshape information at such high acceleration. It was also applied to in-vivo COSY and J-resolved spectroscopy at 7T.
- ◇ Designed a ultra-high resolution variable density spiral MR sequence for collection of spectroscopic data in just 7.2 minutes. Developed a low-rank constraint based algorithm with orthogonality priors applicable to cartesian and non-cartesian data, for reconstruction of spectroscopic imaging data without using any lipid suppression.
- ◇ Developed mathematical models and optimal control strategies to minimize the cost of production of steel in an electric arc furnace, determined by the chemistry of steel. Developed graphical user interface to interactively choose parameters and generate optimal input trajectories, reducing production cost by 80 % compared to manually controlled cost.

Education

University of Iowa — Iowa City, IA
PhD Candidate, Electrical and Computer Engineering, GPA-3.84/4 — *January 2013 - present*

- ◇ Thesis Title: **Novel data driven model based reconstruction algorithms for improved and faster spectroscopic imaging**
- ◇ Thesis Advisor: Dr. Mathews Jacob

University of Iowa — Iowa City, IA
Master of Science, Electrical and Computer Engineering, GPA-3.84/4 — *August 2010 - December 2012*

West Bengal University of Technology — Kolkata, India
Bachelor of Technology, Electronics and Communication, GPA - 8.95/10 — *August 2005 - June 2009*

- ◇ Thesis title: **Development of a Infrared Remote Controlled Light Dimmer for home appliances**
- ◇ Thesis Advisor: Asit Kumar Datta

Publications

Journal Papers

- **Ipshita Bhattacharya**, Jonathan J. Humston, Christopher M. Cheatum, Mathews Jacob, ***'Accelerating two-dimensional infrared spectroscopy while preserving lineshapes using GIRAF'***, Optics Letters, 2017. (submitted)
- Jonathan J. Humston, **Ipshita Bhattacharya**, Mathews Jacob, and Christopher M. Cheatum, ***'Compressively Sampled Two-Dimensional Infrared Spectroscopy That Preserves Lineshape Information'***, The Journal of Physical Chemistry, 2017.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Compartmentalized low-rank recovery for high resolution lipid unsuppressed MRSI,'***, Magnetic Resonance in Medicine, 2016.
- Shyamal Subramanyam, Mohammed Ismail, **Ipshita Bhattacharya**, Maria Spies, ***'Tyrosine phosphorylation stimulates activity of human RAD51 recombinase through altered nucleoprotein filament dynamics'***, Proceedings of the National Academy of Sciences, 2016.

In Preparation

- ***De-interleaving and Denoising of Echo-Planar Spectroscopic Imaging (EPSI) data using structured low-rank recovery algorithm***

Conference Papers and Abstracts

- **Ipshita Bhattacharya**, Ralph Noeske, Baolin Yang, Rolf F. Schulte, Mathews Jacob, ***'High Resolution MRSI using compartmental low rank algorithm: demonstration using undersampled EPSI'***, International Society for Magnetic Resonance in Medicine (ISMRM), Honolulu, USA, April 2017.
- Cameron Cushing, **Ipshita Bhattacharya**, Ralph Noeske, William Kearney, Baolin Yang, Mathews Jacob, Vincent A. Magnotta, ***'Comparison of Undersampling Schemes for in-vivo COSY and J-resolved Spectroscopy at 7T'***, 58th Experimental Nuclear Magnetic Resonance Conference, Asilomar Conference Grounds, Pacific Grove, California, USA, March 2017.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Rapid Data Acquisition and Reconstruction Method for High Resolution Metabolic Imaging using Magnetic Resonance Spectroscopic Imaging'***, Holden Comprehensive Cancer Center Scientific Research Retreat, Iowa, USA, June 2016.
- **Ipshita Bhattacharya**, Jonathan J. Humston, Christopher M. Cheatum, Mathews Jacob, ***'Accelerating Two-dimensional Infrared Spectroscopy using Structured Low Rank Matrix Recovery'***, Holden Comprehensive Cancer Center Scientific Research Retreat, Iowa, USA, June 2016.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Low-rank based compartmentalized reconstruction algorithm for high resolution MRSI without lipid suppression methods'***, International Society for Magnetic Resonance in Medicine (ISMRM), Singapore, May 2016.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Compartmentalized low-rank regularization with orthogonality constraints for high resolution MRSI'***, IEEE-International Society of Biomedical Imaging (ISBI), Prague, Czech Republic, April 2016.
- **Ipshita Bhattacharya**, Jonathan J. Humston, Christopher M. Cheatum, Mathews Jacob, ***'Accelerating 2D Infrared Spectroscopy using Structured Low Rank Matrix Recovery'***, The 18^{th} Annual Jakobsen Memorial Graduate Conference, Iowa City, USA, March 2016.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Fast Data Acquisition and Reconstruction Methods for lipid unsuppressed Metabolic imaging'***, ISMRM workshop on Data Sampling and Image Reconstruction, Sedona, Arizona, Jan 2016.

- **Ipshita Bhattacharya**, Mathews Jacob, ***'High Resolution 1H MRSI Without Lipid Suppression at short echo times using variable density spirals'***, International Society for Magnetic Resonance in Medicine (ISMRM), Toronto, Canada, 2015.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Novel sequence and algorithm for high resolution artifact free MRSI reconstruction'***, The 17^{th} Annual Jakobsen Memorial Graduate Conference , Iowa City, USA, March 2015.
- **Ipshita Bhattacharya**, Mathews Jacob, ***'Compressed Sensing based artifact free Magnetic Resonance Spectroscopic Imaging(MRSI) Reconstruction Methods'***, College of Engineering Research Open House,The University of Iowa, Iowa City,USA, May 2015.
- **Ipshita Bhattacharya**, Er-Wei Bai, ***'Modeling and Optimal Energy Efficiency of Electric Arc Furnace'***, College of Engineering Research Open House,The University of Iowa, Iowa City,USA, May 2012.
- **Ipshita Bhattacharya**,***'A Comprehensive Study on Speech Recognition'*** ,97th Indian Science Congress, Thiruvananthapuram, India, Jan 2010.

Honors and Awards

- Dr. Eunice Schuytema Beam Travel Grant,University of Iowa Women in Science and Engineering (WISE) Program, 2017
- Graduate and Professional Student Government Travel Award, 2017
- Graduate Student Senate Travel Grant, The University of Iowa, 2016
- ISMRM Magna Cum Laude Merit Award, 2016
- ISMRM Educational Stipend Award, Year 2015-2017
- Best Graduate poster award at the College of Engineering Research Open House, The University of Iowa, 2012

Work Experience

Research Assistant University of Iowa, IA
January 2013 - present

- Worked at the Computational Biomedical Imaging Group with Dr. Mathews Jacob. Developed image reconstruction and denoising algorithms for high resolution Magnetic Resonance Spectroscopic Imaging by exploiting underlying model of the data, and novel algorithms to accelerate two-dimensional infrared spectroscopy.

Research Assistant University of Iowa, IA
June 2011 - December 2012

- Successfully developed optimal control system strategies for electric arc furnace management with Dr. Er-Wei Bai. Constructed a numerical model for electrical arc furnaces and graphical user interface software for automated optimal controlling using linear quadratic regulation algorithms.

Teaching Assistant University of Iowa, IA

- Assisted the following courses: Digital Signal Processing (August-December 2016), Computer based Control Systems (August-December 2012), Principles of Electronics and Instrumentation (January-May 2011), Computers in Engineering and Electrical Circuits (August-December 2010)

Worked as a Software Engineer Trainee Tata Consultancy Services,India
March 2010 - July 2010

- Received training on Java,C++ code development and database management (SQL).

Microcontroller based Temperature Controlling System Summer 2008
Microsoft Gold Certified Partner *Micro Pro, Kolkata, India*

◇ Implemented a microcontroller (895C1 based) based temperature controlled system for electric furnaces, air conditioning machines and incubators.

A comprehensive study on Speech Recognition Spring 2008
Indian Institute of Technology, Kharagpur

◇ Developed signal processing features based algorithm for speech recognition. Built a simple hardware prototype for recognizing spoken words from a dictionary of word fingerprints.

Tools & Programming Languages

◇ MATLAB, C++, Python

◇ MR Sequence Programming

- GE-EPIC Programming
- Siemens-IDEA Sequence

◇ LaTeX

◇ Bash Scripting

Professional Training and extra-curricular activities

◇ Attended the 2015 GE MR Programming Workshop form August 15^{th} to 21^{st} at the Wisconsin Institute of Medical Research.

◇ Led robotics breakout sessions for middle school girl students as part of Go Girls! STEM Initiative at University of Iowa.