

# Snehashis Roy

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## Skill Summary

- Statistical modeling, computer vision, machine learning and signal processing.
- Demonstrated innovation in the area of segmentation, registration, sparse methods, with applications to biomedical image analysis (MRI, CT)
- Extensive scientific writing experience including experience in writing research grants
- Excellent communication skill with track record of working in multi-disciplinary teams including clinicians, statisticians and MR physicists.

## Education

- Ph.D., Electrical and Computer Engineering.**, The Johns Hopkins University, Baltimore, MD 2012  
Advisor: Dr. Jerry L. Prince.  
Dissertation: *MR Image Contrast Synthesis for Consistent Segmentation*
- M.S., Electrical and Computer Engineering.**, The Johns Hopkins University, Baltimore, MD 2010  
Advisor: Dr. Jerry L. Prince.
- B.Tech. (Honors), Electronics and Electrical Communication Engineering.**, Indian Institute of Technology, Kharagpur, India 2006  
Dissertation: *Impulse Noise Reduction using Motion Estimation based Filter - Conception of In-Loop Filter Integrated with H.264/AVC*

## Experience

- Research Scientist,** From  
*Center for Neuroscience and Regenerative Medicine, Henry Jackson Foundation, Bethesda, MD* 2015-August
- Developed a method for brain stripping from multi-contrast MR images in presence of traumatic brain injuries. The software is publicly available at [www.nitrc.org/projects/monstr](http://www.nitrc.org/projects/monstr)
  - Developed a method for cerebral microbleed segmentation from susceptibility weighted images
  - Developed a novel longitudinal MS lesion segmentation algorithm from brain images
  - Proposed a method for whole head image synthesis, which can be used for better distortion correction in eco-planar images
- Postdoctoral Fellow,** 2013-July  
*Center for Neuroscience and Regenerative Medicine, Henry Jackson Foundation, Bethesda, MD* to  
2015-August
- Designed an accurate PET reconstruction from PET/MR scanners using ultra-short echo (UTE) MR images via synthetic CT
  - Developed a longitudinal MR intensity normalization method to stabilize longitudinal tissue segmentations of MR scans
  - Proposed a sparse dictionary learning method for whole brain tissue segmentation and lesion segmentation of MR images from patients with Multiple Sclerosis
- Postdoctoral Fellow,** 2013-January  
*Johns Hopkins University, Baltimore, MD* to  
2013-July
- Formulated a new registration method of brain MR to CT images in presence of tumors via synthetic CT images
  - Helped in writing grant, "MR Image Example based Contrast Synthesis for Consistent Image Analysis", PI Dr. Jerry L. Prince, NIH/NIBIB, 1R21EB012765

## Research Assistant,

Johns Hopkins University, Baltimore, MD

- Proposed an image synthesis method using sparse prior techniques on brain MR images to synthesize various MR tissue contrasts to achieve consistency in segmentation results obtained from images acquired at various sites and scanners. This is also publicly available at [www.nitrc.org/projects/image\\_synthesis](http://www.nitrc.org/projects/image_synthesis) 2009-2012
- Proposed a technique to synthesize FLAIR from T<sub>1</sub> MR scans to improve white matter lesion segmentation 2009
- Developed a Rician mixture model based brain MR image segmentation technique for the purpose of consistent tissue segmentation from different acquisitions of same MR image, where inconsistencies arise from the differences in pulse sequences 2007-2008

## Patents

- J. L. Prince, **S. Roy**, D. L. Pham, A. Carass, J. Lee, W.-T. Wang, J. A. Butman, "System and method for CT Image Synthesis from MRI Using Generative Sub-Image Synthesis", WO2015175852 A1.  
**Invention:** A generative method to synthesize CT from dual-echo Ultra-short echo (UTE) MR images for accurate attenuation correction of Positron Emission Tomography (PET) images
- A. Jog, **S. Roy**, A. Carass, J. L. Prince, "Pulse Sequence Based Intensity Normalization and Contrast Synthesis for Magnetic Resonance Brain Imaging", US 20150016701, 2015.  
**Invention:** A method to synthesize multiple tissue contrasts and normalize intensities for MR images through nonlinear regression on patches.

## Awards and Honors

- **Invited Speaker:** SPIE Medical Imaging Conference (Florida, US), 2016
- **Alavi-Mandell award** by Society of Nuclear Medicine and Molecular Imaging (SNMMI) for a major contribution based on the publication "PET Attenuation Correction using Synthetic CT from Ultrashort Echo-time MRI", 2015.
- **Best Poster Award**, International Conference on Information Processing in Medical Imaging (IPMI 2011), Germany.
- **Rob Roy Fellowship** (2006-2008), Johns Hopkins University.

## Computer Skills

- Programming in Matlab, C, Python
- Conversant with neuroimaging tools, MIPAV, FSL, Freesurfer

## Scientific Reviewer

- Program Committee in International Workshop on Simulation and Synthesis in Medical Imaging (SASHIMI), 2016, Athens, Greece.
- ISBI (Intl. Symposium on Biomedical Imaging) 2015, New York.
- MICCAI (Medical Image Computing and Computer Assst. Intervention) 2015, Munich, Germany.
- MICCAI (Medical Image Computing and Computer Assst. Intervention) 2016, Athens, Greece.
- IEEE Transactions on Medical Imaging, NeuroImage, IEEE Transactions on Image Processing, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Circuits and Systems and Video Technology, Journal of Visual Communication and Image Representation, Computers in Biology and Medicine, PLOS One

## Journal Publications

- **S. Roy**, A. Carass, J. Pacheco, M. Bilgel, S. M. Resnick, J. L. Prince, D. L. Pham, "Temporal filtering of longitudinal brain magnetic resonance images for consistent segmentation", *NeuroImage: Clinical*, 11: 1598-1609, 2016.
- **S. Roy**, Q. He, E. Sweeney, A. Carass, D. S. Reich, J. L. Prince, D. L. Pham, "Subject specific sparse dictionary learning for atlas based brain MRI segmentation", *IEEE Journal of Biomedical and Health Informatics*, 19(5): 1598-1609, 2015.
- A. Jog, A. Carass, **S. Roy**, D. L. Pham, J. L. Prince, "Random Forest Regression for Magnetic Resonance Image Synthesis", *Medical Image Analysis*, 35(1): 475-488, 2016

- N. E. Fritz, **S. Roy**, J. Keller, J. L. Prince, P. A. Calabresi, K. M. Zackowski, "Pain, cognition and quality of life associate with structural measures of brain volume loss in multiple sclerosis", *NeuroRehabilitation*, 1-10, 2016 (In Press)
- M. Chen, A. Carass, A. Jog, J. Lee, **S. Roy**, J. L. Prince,, "Cross contrast multi-channel image registration using image synthesis for MR brain images", *Medical Image Analysis*, 2016 (in Press)
- S. Saidha, O. Al-Louzi, J. N. Ratchford, P. Bhargava, J. Oh, S. D. Newsome, J. L. Prince, D. Pham, **S. Roy**, P. van Zijl, L. J. Balcer, E. M. Frohman, D. S. Reich, C. Crainiceanu, P. A. Calabresi, "Optical coherence tomography reflects brain atrophy in MS: A four year study", *Annals of Neurology*, 78(5): 801-813, 2015.
- A. Jog, A. Carass, **S. Roy**, D. L. Pham, J. L. Prince, "MR Image Synthesis by Contrast Learning On Neighborhood Ensembles", *Medical Image Analysis*, 24(1): 63-76, 2015
- D. M. Harrison, **S. Roy**, J. Oh, I. Izbudak, D. L. Pham, S. Courtney, B. Caffo, C. K. Jones, P. van Zijl, P. A. Calabresi, "Association of cortical lesion burden on 7T MRI with cognition and disability in multiple sclerosis", *JAMA Neurology*, 72(9): 1004-1012, 2015.
- D. M. Harrison, J. Oh, **S. Roy**, E. T. Wood, A. Whetstone, M. A. Seigo, C. K. Jones, D. L. Pham, P. van Zijl, D. S. Reich, P. A. Calabresi, "Thalamic lesions in multiple sclerosis by 7T MRI: clinical implications and relationship to cortical pathology", *Multiple Sclerosis*, 21(9): 1139-1150, 2015.
- **S. Roy**, W. T. Wang, A. Carass, J. L. Prince, J. A. Butman, D. L. Pham, "PET Attenuation Correction using Synthetic CT from Ultrashort Echo-time MRI", *Journal of Nuclear Medicine*, 55(12): 2071-2077, 2014.
- **S. Roy**, A. Carass, J. L. Prince, "Magnetic Resonance Image Example based Contrast Synthesis", *IEEE Trans. Med. Imaging*, 32(12): 2348-2363, 2013.
- B. A. Landman, J. A. Bogovic, A. Carass, M. Chen, **S. Roy**, N. Shiee, Z. Yang, B. Kishore, D. L. Pham, P. L. Bazin, S. Resnick, J. L. Prince, "System for Integrated Neuroimaging Analysis and Processing of Structure", *NeuroInformatics*, 11(1):91-103, 2013.
- **S. Roy**, A. Carass, P. L. Bazin, S. Resnick, J. L. Prince, "Consistent segmentation using a Rician classifier", *Medical Image Analysis*, 16(2): 524-535, 2012.

### Selected Conference Publications

- **S. Roy**, Y. Y. Chou, A. Jog, J. A. Butman, D. L. Pham "Patch Based Synthesis of Whole Head MR Images: Application to EPI Distortion Correction", *Simulation and Synthesis in Medical Imaging (SASHIMI)*, 2016:146-156.
- L. M. Ellingsen, **S. Roy**, A. Carass, A. M. Blitz, D. L. Pham, J. L. Prince " Segmentation and labeling of the ventricular system in normal pressure hydrocephalus using patch-based tissue classification and multi-atlas labeling", *SPIE (Medical Imaging)*, 2016 (**Oral Presentation**).
- **S. Roy**, A. Carass, J. L. Prince, D. L. Pham, "Longitudinal Patch-Based Segmentation of Multiple Sclerosis White Matter Lesions", *6<sup>th</sup> Intl. Workshop on Machine Learning in Medical Imaging (MLMI)*, 2015.
- **S. Roy**, A. Jog, E. Magrath, J. A. Butman, D. L. Pham "Cerebral microbleed segmentation from susceptibility weighted images", *SPIE (Medical Imaging)*, 2015 (**Oral Presentation**).
- **S. Roy**, S. Wilkes, R. Diaz-Arrastia, J. A. Butman, D. L. Pham " Intraparenchymal Hemorrhage Segmentation from Clinical Head CT of Patients with Traumatic Brain Injury", *SPIE (Medical Imaging)*, 2015 (**Oral Presentation**).
- Q. He, **S. Roy**, A. Jog, D. L. Pham, "An example-based brain MRI simulation framework", *SPIE (Medical Imaging)*, 2015 (**Oral Presentation**).
- **S. Roy**, A. Carass, J. L. Prince, D. L. Pham, "Subject Specific Sparse Dictionary Learning for Atlas based Brain MRI Segmentation", *5<sup>th</sup> Intl. Workshop on Machine Learning in Medical Imaging (MLMI)*, 2014: 248-255.
- **S. Roy**, A. Carass, A. Jog, J. L. Prince, "MR to CT registration of brains using image synthesis", *SPIE (Medical Imaging)*, 2014 (**Oral Presentation**).
- **S. Roy**, Q. He, A. Carass, A. Jog, J.L. Cuzzocreo, D. S. Reich, J. L. Prince, D. Pham, "Example based lesion segmentation", *SPIE (Medical Imaging)*, 2014.
- A. Jog, **S. Roy**, J. L. Prince, A. Carass, "MR brain segmentation using decision trees", *MICCAI Grand Challenge on MR Brain Segmentation*, 2013.
- **S. Roy**, A. Jog, A. Carass, J. L. Prince, "Atlas based intensity transformation of brain MR images", *3<sup>rd</sup> Intl. Workshop on Multimodal Brain Image Analysis (MBIA)*, 2013: 51-62. (**Oral Presentation**)

- **S. Roy**, A. Carass, N. Shiee, D.L. Pham, P. Calabresi, D. Reich, J. L. Prince, "Longitudinal Intensity Normalization in the presence of Multiple Sclerosis Lesions", *Intl. Symp. Biomedical Imaging (ISBI)*, 2013: 1384-1387.
- **S. Roy**, A. Carass, J. L. Prince, "Patch Based Intensity Normalization of Brain Images", *Intl. Symp. Biomedical Imaging (ISBI)*, 2013: 342-345.
- A. Jog, **S. Roy**, A. Carass, J. L. Prince, "Magnetic Resonance Image Synthesis through Patch Regression", *Intl. Symp. Biomedical Imaging (ISBI)*, 2013: 350-353.
- **S. Roy**, A. Carass, J. L. Prince, "Longitudinal intensity normalization of magnetic resonance images using patches", *SPIE (Medical Imaging)*, 2013 (**Oral Presentation**).
- A. Jog, **S. Roy**, A. Carass, J. L. Prince, "Pulse sequence based multi-acquisition MR intensity normalization", *SPIE (Medical Imaging)*, 2013.
- M. Bilgel, **S. Roy**, A. Carass, P. A. Nyquist, J. L. Prince, "Automated anatomical labeling of the cerebral arteries using belief propagation", *SPIE (Medical Imaging)*, 2013.
- J. Woo, Y. Bai, **S. Roy**, E. Murano, M. Store, J. L. Prince, "Super-resolution reconstruction for tongue MR images", *SPIE (Medical Imaging)*, 2012: 83140.
- **S. Roy**, A. Carass, J. L. Prince, "A Compressed Sensing Approach for MR Tissue Contrast Synthesis", *Intl. Conf. on Information Proc. Med. Imaging (IPMI)* 2011: 371-383 (**Best Poster Award**).
- **S. Roy**, A. Carass, J. L. Prince, "Compressed sensing based intensity nonuniformity correction", *Intl. Symp. Biomedical Imaging (ISBI)* 2011: 101-104.
- **S. Roy**, A. Carass, J. L. Prince, "Intensity Inhomogeneity Correction of Magnetic Resonance Images using Patches", *SPIE (Medical Imaging)*, 2011: 7962 (**Oral Presentation**).
- **S. Roy**, A. Carass, N. Shiee, D. L. Pham, J. L. Prince, "MR Contrast Synthesis for Lesion Segmentation", *Intl. Symp. Biomedical Imaging (ISBI)* 2010: 932-935.
- **S. Roy**, A. Carass, J. L. Prince, "Synthesizing MR Contrast and Resolution through a Patch Matching Technique", *SPIE (Medical Imaging)* 2010: 7623 (**Oral Presentation**).
- **S. Roy**, A. Carass, P. L. Bazin, J. L. Prince, "A Rician Mixture Model Classification Algorithm for Magnetic Resonance Images", *Intl. Symp. Biomedical Imaging (ISBI)* 2009: 406-409 (**Oral Presentation**).
- **S. Roy**, H. Agarwal, A. Carass, Y. Bai, D. L. Pham, J. L. Prince, "Fuzzy C Means with Variable Compactness", *Intl. Symp. Biomedical Imaging (ISBI)* 2008: 452-455.

## Abstracts

- **S. Roy**, W. T. Wang, J. Butman, D. L. Pham, "Accurate PET Reconstruction for PET/MR Scanners using Synthetic CT", *Intl. Soc. For Magnetic Res. in Med. (ISMRM)*, 2014 (**E-poster, oral presentation**).
- **S. Roy**, A. Carass, N. Shiee, D. L. Pham, S. Resnick, J. L. Prince, "Longitudinal Changes in White Matter Lesions", *Intl. Soc. For Magnetic Res. in Med. (ISMRM)*, 2010. (**E-poster, oral presentation**).