Sudhir K. Pathak

Biomedical Engineer · Computational Mathematician

153 Lloyd Avenue FL 2 Pittsburgh PA 15218 USA

(+1) 412-496-2265 | skpathak@gmail.com | sudhirpathak.com | skpathak | sudhirkpathak

Education and Experience

Learning Research and Development Center, University of Pittsburgh — *Pittsburgh, PA*

Research Associate — *May 2015 - Current*

- Research Topic: Validation of diffusion models based on hollow textile phantoms. Ex-vivo biological diffusion model pig visual system.
- Research Areas: Validation of diffusion models, Traumatic Brain Injury, Diffusion MRI, Fiber tracking
- Project Director: Dr. Walter Schneider

Bioengineering Department, University of Pittsburgh — *Pittsburgh, PA*

Ph.D., Bioengineering — *May 2010 - December 2015*

- Thesis Topic: Improved Quantification of Connectivity in Human Brain Mapping
- Area of Study: Diffusion magnetic resonance imaging
- Committee: Dr. Walter Schneider, Dr. Peter Basser, Dr. George Stetten, Dr. Juan Miranda Fernandez, Dr. Howard Aizenstein, Dr. John Galeotti

Learning Research and Development Center, University of Pittsburgh — *Pittsburgh, PA*

System Programmer — *May 2006 - December 2010*

- Research Topic: Predicting brain state using functional MRI and developing diffusion MRI based connectivity analysis.
- Research Areas: Functional and diffusion magnetic resonance imaging
- Project Director: Dr. Walter Schneider

Department of Biomedical Engineering, Carnegie Mellon University — *Pittsburgh, PA*

M.S., Biomedical Engineering — *August 2004 - December 2006*

- Thesis Topic: Optimal Elastic Registration of Cardiac Images
- Area of Study: Medical image registration

Mathematics Department, Indian Institute of Technology Kanpur — *Kanpur, Uttar Pradesh, INDIA*

M.Sc. (Integrated) and B.S., Mathematics and Scientific Computing — *August 1999 - May 2004*

- Thesis Topic: Numerical Simulation of Cardiac Electrical Activity
- Area of Study: Electro-physiology of human heart

IDEA Sequence Programming VE11, Pulse programming course — *North Carolina*

Siemens Healthineers Headquarters — *October 2019*

- Topic: Sequence incorporation and Program implementation, Sequence Simulation, Real Time Events, Image Calculation Environment

Expertise

Applied Mathematics	Parallel Numerical Mathematics, Mathematical Optimization, Finite Element Method.
Computer Science	Graphics/Shader Programming, Deep Learning, Machine Learning, Unsupervised Clustering Technqiues, Multi-Variate Pattern Analysis(MVPA) on fMRI datasets.
Medical Imaging	Multi-model Registration, Brain tissue Segmentation, Resting State Connectivity, Diffusion MR Imaging, Fiber Tractography.
Neuroscience	Functional Neuroanatomy, White Matter Anatomy, Cognitive Neuroscience.
Neuroimaging Packages	Freesurfer, FSL, AFNI, ANTS, MRTRIX, MNE-python, Osirix.

Software Skills

Computer Programming	C, C++, Python, LaTeX, Bash Shell Scripting and CMAKE.
Numerical Analysis	MATLAB, R, Tidyverse, ShinyApp and Mathematica
Python Package	OpenCV, Pandas, Scikit-learn, SciPY, NumPY and DiPY
Visualization Libraries/Softwares	D3.js, ITK, VTK, Paraview, CUDA, OpenGL/ES and WebGL
Parallel/Deep-Learning Computing Libraries	MPI, PETSc, FeniCS, PyTorch, Keras

Current Research Projects

High Definition Fiber Tracking (HDFT) and Diffusion Modeling

Learning Research and Development Center, Univeristy Of Pittsburgh

- Designed a novel mathematical diffusion model that combines diffusion spectrum imaging and Multi-shell imaging and constrained spherical deconvolution Technique.
- Combined and ultilized diffusion MRI based tractography and klinger dissection technqiue to map brain networks involved in language (Arcuate and SLF) and consciousness (Claustrum).
- Designed and optimized a full pipeline of diffusion MRI analysis to create anatomically valid tracks.
- Used HDFT pipeline implementation to optimize diffusion analysis for multi-band tecnhqiue (reducing scanning time) across major MRI scanners (Siemens, GE and Philips).

July 2014 - PRESENT

Neuroanatomical Validation of HDFT

Learning Research and Development Center, Univeristy Of Pittsburgh and UPMC

- Developed a novel and anatomically related diffsion anisotropic metric, directional axonal volume (dAV), to quantify of white matter tracts.
- Lead a novel project to validate mathematical models of diffusion and related anisotropic metric using a hollow fiber based textile phantom. First time textile phantom has been used to create restricted compartment for clinical scanner.
- Designed analysis processes for combining diffusion MRI based metric across multiple sites and multiple scanners in US and Europe.

July 2010 - PRESENT

Clinical and Neuroscientific Application of HDFT

Learning Research and Development Center, Univeristy Of Pittsburgh and UPMC

- Formulated an algorithm for pre-surgical planning to provide and predict surgical route that can minimize brain tissue damage during neurosurgical procedures.
- Enhanced visualization of HDFT-based fiber tracks in real time during neurosurgery.
- Designed and implemented code using IGSTK to interface neuro-navigation systems (BrainLAB and Stryker) for visualization of HDFT-based fiber tracts.
- Developed a voxewise and tract-based techniques using diffusion MRI based anisotropic metric to track the progression of neurodegenerative diseases such as Huntington's and ALS.
- Identified and implemented tracts and voxelwise techniques that can relate HDFT-based structural connectivity and neuropycological scores in stroke patients (Aphasia).
- Developed mathematical technqiues (non-negative matrix factorization) and biophysical diffusion models to localize brain damages in traumatic brain injury (TBI).

July 2011 - PRESENT

Eye and Hand transplant project

Learning Research and Development Center, Univeristy Of Pittsburgh and UPMC

- Designed a diffusion MRI based tractograhy method to localize of peripheral nervous system (hand, face and leg) for limb transplant.
- Developed diffusion protocol on 3T and 7T to image Median Nerve in human hand.
- Enhanced diffusion MRI based techniques that can resolve crossing, quantify white matter that relates to amount of axons in Optic nerve, tract and radiation in a exvivo pig visual system Brain on 7T Bruker Machine.

July 2015 - PRESENT

Clinical Application of Magnetoencephalography (MEG)

Unversity of Pittsburgh Medical Center

- Systemitized localization of eloquent cortices (motor, somatosensory, language and visual) in patient population using novel clinical pipeline.
- Designed a classification method based on resting state MEG data for TBI patient population using network analysis.
- Combined HDFT-based structural connectivity and MEG based evoked and resting state functional connectivity in normal human polpulation. This data set can futher be used for comparison of TBI population.

July 2012 - PRESENT

Past Research Projects

fMRI based Functional Connectivity

Learning Research and Development Center, Univeristy Of Pittsburgh

July 2006 - May 2010

- Developed a novel method (Global Connectivity) to identify most connected brain regions in human brain using resting state fMRI.
- Used machine learning based (support vector machine) method to predict brain state using task based fMRI.
- Systemitized localization of eloquent cortices (motor, somatosensory, languague and visual) using task-based fMRI using various neuro-imaging packages (AFNI, FSL).

Simulation of Cardiac Electro-physiology and Registration of Cardiac MRI

Carnegie Mellon University and Indian Institute of Technology Kanpur

May 2002 - May 2004

- Simulated cardiac electrical activity using bi-domain reaction diffusion PDF on left ventricle of human heart.
- Designed and implemented a three dimensional finite element model of a system of partial differential equations on parallel distributed computers using PetSc (MPI) library.
- Formulated mathematical model for elastic registration of time varying cardiac MR images to estimate tissue displacement.

Grants

DEVELOPMENT and NEUROSURGICAL APPLICATION OF HIGH DEFINITION FIBER TRACKING (HDFT)

Scheme for Promotion of Academic and Research Collaboration (SPARC)

Principle Investigator

2020

THALAMIC SEGMENTATION USING ADVANCED IMAGING

International Radiosurgery Research Foundation (IRRF)

Co-Principle Investigator (PI: Dr. Ajay Niranjan)

2020

QUALITATIVE AND QUANTITATIVE ANALYSIS OF THE STRUCTURE OF THE WHITE MATTER OF THE HUMAN BRAIN

The Walter L. Copeland Fund of the Pittsburgh Foundation Funding for Cranial Research

Co-Principle Investigator (PI: Dr. Juan Miranda Fernandez)

2011

HIGH DEFINITION FIBER TRACKING IN NEUROSURGERY

The Walter L. Copeland Fund of the Pittsburgh Foundation Funding for Cranial Research

Co-Principle Investigator (PI: Dr. Juan Miranda Fernandez)

2010

Patent

1. Walter SCHNEIDER and Sudhir PATHAK. Directional diffusion fiber tracking, September 21 2012. WO Patent 2,012,125,829 A2
2. Anthony P Zuccolotto, John Dzikiy, Leroy K Basler, Benjamin A Rodack, Walter Schneider, Sudhir K Pathak, and Michael A Boss. Mri phantom including mri compatible temperature measurement device and pressure expansion bladder device, December 19 2019. US Patent App. 16/443,323

Teaching Experience

PSY 2575: Mapping Human Brain Connectivity — *University of Pittsburgh*

Co-Instructor — *Fall 2020/2019/2018, Spring 2017/2014, Spring 2012*

- Responsible for lecture on mathematics behind MRI, diffusion MRI.
- Lectures on image registration and advanced techniques to quantify of white matter tissue in human brain.

PSY 2476: Brain Connectivity Mapping — *University of Pittsburgh*

Teaching Assistant — *January 2009 to May 2009*

- Responsible for 2-hour lecture and supervision of 2-hour laboratory.
- Authored course material and lab sessions.

BME 42735: Medical Image Analysis — *Carnegie Mellon University*

Guest Lecturer — *April 2010, April 2012*

- Graduate-level course in medical imaging (Registration and Segmentation)
- Lecture: "Basic MRI, Diffusion MRI, Neuroanatomy and Fiber Tracking".

Professional Activites and Awards

Editorial Board Member — *Claustrum*

Claustrum Journal. — *July 2015*

Editor's Choice award in Methods and Modeling — *Neuroimage*

Identifiying brain most globally connected regions — *June 2010*

Best Project Award for M.Sc. thesis — *Mathematics Department, IIT Kanpur*

Simulation of electrophysiology of Heart — *May 2004*

University Scholarship — *IIT Kanpur*

Indian Instiutute of Technology, Kanpur. — *May 2002*

Regional Mathematical Olympiad Competition — *Delhi Association*

Qualified a regional Mathematical Olympiad Competition conducted by regional delhi association — *March 1998*

Media and Special Reports

***Discover Magazine:* High Definition Fiber Tracking** — *Discover*

Broken Cables: High-definition imaging helps researchers map the damage from traumatic brain injury with unprecedented accuracy. — *September 2015*

***Discovery Channel:* High Definition Fiber Tracking** — *Discovery Channel*

Exploring High Definition Fiber Tracking: Physician Education, Neurology-Neurosurgery — *April 2013*

***Gehirn und Geist Magazine:* Corpus Callosm Rendering** — *Gehirn und Geist, Page 49*

Verbindungskabel in Kopf — *February 2013*

***Scientific American:* Corpus Callosm Rendering** — *Scientific American, Page 54-55*

The Mystery of the Missed Connection: A common but little understood malformation reveals the brain's incredible plasticity. — *February 2013*

***Neurosurgery Newsletter:* Special Report on High Definition Fiber Tractography** — *Neurosurgery Newsletter*

University of Pittsburgh Medical Center, Neurosurgery Newsletter, Volume 13, Number 1 — *December 2012*

- Juan C. Fernandez-Miranda, Sudhir Pathak, Walter Schneider, High Definition Fiber Tractography: Unraveling the connections of the human brain.
- Johnathan Engh, Sudhir Pathak, Juan C. Fernandez-Miranda, HDFT endoscopic port surgery synergistic in management of deep brain tumors.
- Arlan Mintz, Johnathan Engh Sudhir Pathak, Intra-operative use of HDFT with image-guidance valuable in awake craniotomy for tumor resection.

***Scientific American:* High Definition Fiber Tracking rendering** *Scientific American, Page 43*

HEAD SHOTS: Artistry abounds in these 10 maps of the human mind *December 2011*

***60 MINUTES, CBS News:* High Definition Fiber Tracking** *CBSNEWS*

60 MINUTES: Apps for Autism *October 23, 2011*

Refereed Journal Publications

1. Vishwesh Nath, Sudhir K Pathak, Kurt G Schilling, Walt Schneider, and Bennett A Landman. Deep learning estimation of multi-tissue constrained spherical deconvolution with limited single shell dw-mri. volume 11313, page 113130S. International Society for Optics and Photonics, 2020
2. Sandip Panesar, Vishwesh Nath, Sudhir Pathak, Walter Schneider, Bennett Landman, Michael Iv, Diana Anthony, Tatiana Jansen, Kumar Abhinav, and Juan Fernandez-Miranda. Deep learning improves pre-surgical white matter visualization in glioma patients. *medRxiv*, 2020
3. Kristofer Pomiecko, Carson Sestili, Kate Fissell, Sudhir Pathak, David Okonkwo, and Walter Schneider. 3d convolutional neural network segmentation of white matter tract masks from mr diffusion anisotropy maps. *2019 IEEE 16th International Symposium on Biomedical Imaging (ISBI 2019)*, pages 1–5, 2019
4. Ashley L Ware, Brian Biekman, Rebecca Hachey, Marianne MacLeod, William Bird, Sudhir Pathak, Emily Clarke, Allison Borrasso, Ava M Puccio, Kelly Glavin, et al. A preliminary high-definition fiber tracking study of the executive control network in blast-induced traumatic brain injury. *Journal of neurotrauma*, 36(5):686–701, 2019
5. David O Okonkwo, Ross C Puffer, Davneet S Minhas, Sue R Beers, Kathryn L Edelman, Jane M Sharpless, Charles M Laymon, Brian J Lopresti, Steven Benso, Ava M Puccio, et al. [18f] fdg,[11c] pib, and [18f] av-1451 pet imaging of neurodegeneration in two subjects with a history of repetitive trauma and cognitive decline. *Frontiers in neurology*, 10:831, 2019
6. Elisabeth A Wilde, James M Provenzale, Brian A Taylor, Michael Boss, Anthony Zuccolotto, Rebecca Hachey, Sudhir Pathak, David F Tate, Tracy J Abildskov, and Walter Schneider. Assessment of quantitative magnetic resonance imaging metrics in the brain through the use of a novel phantom. *Brain injury*, 32(10):1265–1275, 2018
7. Sandip S Panesar, Fang-Cheng Yeh, Christopher P Deibert, David Fernandes-Cabral, Vijayakrishna Rowthu, Pinar Celtikci, Emrah Celtikci, William D Hula, Sudhir Pathak, and Juan C Fernández-Miranda. A diffusion spectrum imaging-based tractographic study into the anatomical subdivision and cortical connectivity of the ventral external capsule: uncinate and inferior fronto-occipital fascicles. *Neuroradiology*, 59(10):971–987, 2017
8. Catarina Guise, Margarida M Fernandes, Joao M Nobrega, Sudhir Pathak, Walter Schneider, and Raul Fangueiro. Hollow polypropylene yarns as a biomimetic brain phantom for the validation of high-definition fiber tractography imaging. *ACS Applied Materials & Interfaces*, 8(44):29960–29967, 2016
9. Ahmad Alhourani, Thomas A Wozny, Deepa Krishnaswamy, Sudhir Pathak, Shawn A Walls, Avniel S Ghuman, Donald N Krieger, David O Okonkwo, R Mark Richardson, and Ajay Niranjan. Magnetoencephalography-based identification of functional connectivity network disruption following mild traumatic brain injury. *Journal of Neurophysiology*, 116(4):1840–1847, 2016
10. Masanori Yoshino, Kumar Abhinav, Fang-Cheng Yeh, Sandip Panesar, David Fernandes, Sudhir Pathak, Paul A Gardner, and Juan C Fernandez-Miranda. Visualization of cranial nerves using high-definition fiber tractography. *Neurosurgery*, 2016
11. Xuhui Wang, Sudhir Pathak, Lucia Stefaneanu, Fang-Cheng Yeh, Shiting Li, and Juan C Fernandez-Miranda. Subcomponents and connectivity of the superior longitudinal fasciculus in the human brain. *Brain Structure and Function*, pages 1–18, 2015
12. Nora Presson, Deepa Krishnaswamy, Lauren Wagener, William Bird, Kevin Jarbo, Sudhir Pathak, Ava M Puccio, Allison Borasso, Steven Benso, David O Okonkwo, et al. Quantifying white matter structural integrity with high-definition fiber tracking in traumatic brain injury. *Military medicine*, 180(3S):109–121, 2015

13. Amir H Faraji, Kumar Abhinav, Kevin Jarbo, Fang-Cheng Yeh, Samuel S Shin, Sudhir Pathak, Barry E Hirsch, Walter Schneider, Juan C Fernandez-Miranda, and Robert M Friedlander. Longitudinal evaluation of corticospinal tract in patients with resected brainstem cavernous malformations using high-definition fiber tractography and diffusion connectometry analysis: preliminary experience. *Journal of neurosurgery*, 123(5):1133–1144, 2015

14. Kumar Abhinav, Fang-Chang Yeh, Sudhir Pathak, Robert M Friedlander, and Juan C Fernandez-Miranda. Advanced diffusion mri fiber tracking in neurosurgical and neurodegenerative disorders and neuroanatomical studies: A review. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease*, 2014

15. Kumar Abhinav, Sudhir Pathak, R Mark Richardson, Johnathan Engh, Paul Gardner, Fang-Cheng Yeh, Robert M Friedlander, and Juan C Fernandez-Miranda. Application of high-definition fiber tractography in the management of supratentorial cavernous malformations: A combined qualitative and quantitative approach. *Neurosurgery*, 74(6):668–681, 2014

16. Juan C Fernández-Miranda, Yibao Wang, Sudhir Pathak, Lucia Stefaneau, Timothy Verstynen, and Fang-Cheng Yeh. Asymmetry, connectivity, and segmentation of the arcuate fascicle in the human brain. *Brain Structure and Function*, pages 1–16, 2014

17. Greg Bowden, Ajay Niranjan, Erika Laing, Sudhir Pathak, John Flickinger, and L Dade Lunsford. Integration of magnetoencephalography-generated functional brain maps into dose planning during arteriovenous malformation radiosurgery. *Stereotactic and functional neurosurgery*, 92(2):103–108, 2014

18. Yibao Wang, Juan C Fernández-Miranda, Timothy Verstynen, Sudhir Pathak, Walter Schneider, and Fang-Cheng Yeh. Rethinking the role of the middle longitudinal fascicle in language and auditory pathways. *Cerebral cortex*, 23(10):2347–2356, 2013

19. Jeffrey S Phillips, Adam S Greenberg, John A Pyles, Sudhir K Pathak, Marlene Behrmann, Walter Schneider, Michael J Tarr, et al. Co-analysis of brain structure and function using fMRI and diffusion-weighted imaging. *J. Vis. Exp*, 69:4125, 2012

20. Juan C Fernandez-Miranda, Sudhir Pathak, Johnathan Engh, Kevin Jarbo, Timothy Verstynen, Fang-Cheng Yeh, Yibao Wang, Arlan Mintz, Fernando Boada, Walter Schneider, et al. High-definition fiber tractography of the human brain: neuroanatomical validation and neurosurgical applications. *Neurosurgery*, 71(2):430–453, 2012

21. Samuel S Shin, Timothy Verstynen, Sudhir Pathak, Kevin Jarbo, Allison J Hricik, Megan Maserati, Sue R Beers, Ava M Puccio, Fernando E Boada, David O Okonkwo, et al. High-definition fiber tracking for assessment of neurological deficit in a case of traumatic brain injury: finding, visualizing, and interpreting small sites of damage: Case report. *Journal of neurosurgery*, 116(5):1062–1069, 2012

22. Timothy Verstynen, Kevin Jarbo, Sudhir Pathak, and Walter Schneider. In vivo mapping of microstructural somatotopies in the human corticospinal pathways. *Journal of neurophysiology*, 105(1):336–346, 2011

23. Michael W Cole, Sudhir Pathak, and Walter Schneider. Identifying the brain's most globally connected regions. *Neuroimage*, 49(4):3132–3148, 2010

24. Juan C Fernandez-Miranda, Johnathan A Engh, Sudhir K Pathak, Ricky Madhok, Fernando E Boada, Walter Schneider, and Amin B Kassam. High-definition fiber tracking guidance for intraparenchymal endoscopic port surgery: Technical note. *Journal of neurosurgery*, 113(5):990–999, 2010

25. B V Rathish Kumar, S K Pathak, Vivek Sangwan, Mohit Nigam, and S K Murthy. A numerical simulation of cardiac electric activity in left ventricle based on mono-domain model. *Journal of Mechanics in Medicine and Biology*, 10(03):431–444, 2010

Paper in Preparation

1. Sudhir K Pathak and Walter Schneider. Assessment of diffusion reconstruction and derived anisotropic metric using a novel hollow textile fiber based phantom. Manuscript in preparation, 2020

2. Sudhir Pathak and Walter Schneider. Estimation of spherical harmonics coefficients of orientation distribution function for diffusion spectrum imaging dataset. Manuscript in preparation, 2020

Book Chapters

1. Ajay Niranjan, Sudhir Pathak, Kevin Fallon, Jong Oh Kim, and L Dade Lunsford. Imaging techniques for leksell radiosurgery. In *Leksell Radiosurgery*, volume 34, pages 28–39. Karger Publishers, 2019
2. Samuel S. Shin, Sudhir Pathak, Nora Presson, William Bird, Lauren Wagener, Walter Schneider, David O. Okonkwo, and Juan C. Fernandez-Miranda. Detection of white matter injury in concussion using High-Definition Fiber Tractography. In Niranjan A. and Lunsford L.D., editors, *Concussion*. Karger, Medical and Scientific Publishers, 2014
3. Sudhir Pathak and JC Fernandez-Miranda. Structural and functional connectivity of the Claustrum in human brain. In J. Smythies, L. Edelstein, and V.S. Ramachandran, editors, *The Claustrum: Structural, Functional, and Clinical Neuroscience*. Academic Press, Academic Press, 2013

Conference Publications

1. Ranjeet Ranjan Jha, Aditya Nigam, Arnav Bhavsar, Sudhir K Pathak, Walter Schneider, and K Rathish. Multi-shell d-mri reconstruction via residual learning utilizing encoder-decoder network with attention (msr-net). In *2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, pages 1709–1713. IEEE, 2020
2. Ranjeet Ranjan Jha, Aditya Nigam, Arnav Bhavsar, Gaurav Jaswal, Sudhir K Pathak, and Rathish Kumar. Hlgsnet: Hierarchical and lightweight graph siamese network with triplet loss for fmri-based classification of adhd. In *2020 International Joint Conference on Neural Networks (IJCNN)*, pages 1–7. IEEE, 2020
3. Walter Schneider, Sudhir Pathak, Kristofer Pomiecko, Cahterine Fissell, David Busch, Anthony Zuccolotto, and Elisabeth Wilde. Calibrated quantitative mri of tbi across space, vendor, site, and time for diffusion quantification of diffuse axonal injury dai. *Neurotrauma*, 36(13):A11–A11, 2019
4. Ahmad Alhourani, Sudhir K Pathak, Michael J Randazzo, Tom Wozny, Efstathios Kondylis, Shawn Walls, Michael Ward, Stephen Foldes, Donald Krieger, David O Okonkwo, et al. 183 meg identification of reduced functional connectivity following concussion. *Neurosurgery*, 62:227–227, 2015
5. Walter Schneider, Sudhir K Pathak, Jeff S Phillips, and Michael W Cole. High Definition Fiber Tracking exposes circuit diagram for brain showing triarchic representation, domain general control, and metacognitive subsystems. In *2009 AAAI Fall Symposium Series*, 2009
6. BS Martins, SK Pathak, AG Bleicher, and W Schneider. Mimimizing brain network damage via fMRI and diffusion weighted imaging in neurosurgical planning. *Neuroimage*, 47:S141, 2009
7. Walter Schneider, Michael Cole, and Sudhir Pathak. Reverse engineering the brain with a circuit diagram based on a segmented connectome and system dynamics. *Proceedings of AAAI Fall Symposium on Biologically Inspired Cognitive Architectures, Washington, DC*, 2008

Oral Presentation

1. Sudhir Pathak. High definition fiber tracking and its clinical application in traumatic brain injury and presurgical planning. Centre for Brain Research (CBR), Indian Institute of Sciences, Bangalore, India, February 2020
2. Sudhir Pathak and Walter Schneider. Idealized axon phantom for validation and calibration of dmri: Testing compartmental models and fiber tractography. New York University, New York, November 2017
3. Sudhir Pathak and Walter Schneider. Hollow nanotube textile based phantoms for ground validation of truth measurement of diffusion mr images: Testing compartmental models and fiber tractography. Computational Brain Connectivity Mapping Winter School Workshop, Antibes, Juan les Pins, France, November 2017
4. Sudhir Pathak and Walter Schneider. High definition fiber tracking - a pipeline of computational methods to map white matter tracts and support clinically viable tract analysis. National Institute of Health, Washington,

DC., March 2013

5. Sudhir Pathak, Timothy Verstynen, Kevin Jarbo, Walter Schneider, and Juan Fernandez-Miranda. High definition fiber tracking (HDFT) in neurosurgery and traumatic brain injury. Cognitive Neuroscience Society, San Francisco, CA, April 2012
6. Schneider W. and Pathak S. High definition fiber tracking in neurosurgery and traumatic brain injury. NIH Neuroimaging group, Wastington DC, December 2010
7. Schneider W., Sudhir Pathak, Timothy Verstynen, Jeff Phillips, Juan Fernandez-Miranda, and Frank Yeh. High definition fiber tracking in visual system to quantify human connectivity and aid neurosurgery to preserve vision. Multi-modal Neuroimaging Training Program (MNTP), Pittsburgh, PA, July 2010
8. Schneider W., Pathak S., and Yeh F. Mapping brain circuits with High Definition Fiber Tracking (HDFT) data mining fiber tracts to identify the cables and chipset of the human brain. Data Mining Group, CMU, Pittsburgh, PA., September 2009
9. Schneider W. and Pathak S. Roadmap for mapping the human connectome. Intel Research, Pittsburgh, PA, December 2009
10. Schneider W., Pathak S., Fernandez-Miranda J., Bleicher A., Davis D., and Boada F. Mapping brain circuits with high definition fiber tracking (HDFT) for medical imaging in neurosurgery and tbi plus human connectome. Radiology Seminar Series, Pittsburgh, PA, September 2009
11. Schneider W., Pathak S., and Phillips J. Adventures in research at LRDC mapping brain architecture actionable neuroscience for learning and support. LRDC Senior Scientists Meeting, Pittsburgh, PA, November 2009
12. Pathak S., Martins B., Cole M.W., and Schneider W. Anatomical and functional segmentation of the cognitive control network: Supporting a preliminary cognitive control network connectome. Cognitive Neuroscience Society, San Francisco, CA, April 2008

Conference Abstract and Posters

1. Sudhir Kumar Pathak, Vishwesh Nath, Sandip Panesar, Kurt G. Schilling, Juan Carlos Fernandez-Miranda, Bennett A. Landman, and Walter Schneider. Clinical recovery of intracellular volume fraction and fiberodf for a patient with asymptomatic temporal-occipital lesion using deep learning. Joint Annual Meeting ISMRM 2020, Virtural Conference, August 2020
2. Sudhir Pathak, Walter Schneider, Anthony Zuccolotto, Susie Huang, Qiuyun Fan, Thomas Witzel, Lawrence Wald, Els Fieremans, Michal E. Komlosh, Dan Benjamini, Alexandru V Avram, and Peter J. Basser. Diffusion ground truth quantification of axon scale phantom: Limits of diffusion mri on 7t, 3t and connectome 1.0. Joint Annual Meeting ISMRM 2020, Virtural Conference, August 2020
3. Sudhir Kumar Pathak, Vinod Jangir Kumar, and Walter Schneider. Validation and estimation of crossing angles of fiber bundle with different density using hollow textile-based phantom. Joint Annual Meeting ISMRM 2019, Montreal, Quebec, Canada, May 2019
4. Walter Schneider, Sudhir Pathak, Yijen Wu, David Busch, and John Dzikiy. Taxon anisotropic phantom delivering human scale parametrically controlled diffusion compartments to advance cross laboratory research and calibration. Joint Annual Meeting ISMRM 2019, Montreal, Quebec, Canada, May 2019
5. Sudhir Kumar Pathak, Catherine Fissell, David Okonkwo, and Walter Schneider. Time-dependent diffusion modeling using a hollow textile-based phantom. Joint Annual Meeting ISMRM-ESMRMB 2018, Paris Expo Porte de Versailles, Paris, France, June 2018
6. Sudhir Kumar Pathak, Catherine Fissell, David Okonkwo, and Walter Schneider. Providing ground truth quantification of anisotropic diffusion mri imaging with a hollow textile phantom. ISMRM 25th Annual Meeting and Exhibition, HONOLULU, HAWAII, USA, April 2017
7. Sudhir K Pathak, Catherine Fissell, Deepa Krishnaswamy, Sowmya Aggarwal, Rebecca Hachey, and Walter Schneider. Diffusion reconstruction by combining spherical harmonics and generalized q-sampling imaging. ISMRM 23rd Annual Meeting and Exhibition, Toronto, Ontario, Canada, June 2015

8. Timothy Verstynen, Kevin Jarbo, Jeff Phillips, Sudhir Pathak, and Walter Schneider. High definition fiber tracking of corticostriatal projection subfields in vivo. Cognitive Neuroscience Society, San Francisco, CA, April 2011

9. Walter Schneider, Timothy Verstynen, Sudhir Pathak, Kate Fissell, Juan Fernandez-Miranda, and Kevin Jarbo. Quality high definition fiber tracking metrics to interpret and optimize connectome mapping accuracy in basic and clinical research. Society for Neuroscience, Washington, DC., November 2011

10. Sudhir Pathak and Walter Schneider. Directional axonal volume: Novel metric to define connectivity in human brain. Society for Neuroscience, Washington, DC., November 2011

11. Verstynen T, Jarbo K, Pathak S., Phillips J., and Schneider W. Characterizing the topography of corticospinal pathways with high definition fiber tractography. Human Brain Mapping, Barcelona, Spain, June 2010

12. Bleicher Andrew, Sudhir K. Pathak, Walter Schneider, Mark R. Lovell, John Norwig, and Joseph C. Maroon. Documenting white matter damage in sports related mild traumatic brain injury with diffusion and high definition fiber tracking. American Society of Functional Neuroradiology, March 2010

13. Schneider W, S. Pathak, J. Fernandez-Miranda, D. Okonkwo, K. Jarbo, J. Engh, A. Mintz, and F. Boada. HD fiber tracking: Non-invasive quantification of fiber tract volume. Society for Neuroscience, San Diego, CA, November 2010

14. Pathak S, Fang-Chen Y, and Schneider W. HD fiber tracking: Non-invasive quantification of fiber tract volume. Society for Neuroscience, San Diego, CA, November 2010

15. Cole M.W., Pathak S., and Schneider W. Identifying the brain's most globally interactive regions. Human Brain Mapping, San Francisco, CA, June 2009

16. Pathak S., Bruna Martins, Schneider W., and Fernandez-Miranda J. White matter damage assessment in neurosurgical planning. Human Brain Mapping, San Francisco, CA, June 2009

17. Fernandez-Miranda J.C., Pathak S., Engh J., Kassam A., Boada F., and Schneider W. High-Definition Fiber Tracking for presurgical planning in minimally invasive endoscopic brain surgery. International Brain Mapping and Intraoperative Surgical Planning Society, Boston, MA, August 2009

18. Schneider W., Pathak S., Phillips J.S., and Cole M.W. High Definition Fiber Tracking exposes circuit diagram for brain showing triarchic representation, domain general control, and metacognitive subsystems. Association for the Advancement of Artificial Intelligence Biologically Inspired Cognitive Architectures, Washington, D.C., November 2009

19. Cole M.W., Pathak S., and Schneider W. Medial frontal cortex directs attention along multiple pathways to resolve perceptual decision difficulty. Cognitive Neuroscience Society, San Francisco, CA, April 2008

20. Fernando Boada, Schneider W., Pathak S., Martin B., Davis D., and Bleichner A. Integration of diffusion weighted imaging and fMRI to identify differential fiber loss in pre-surgical planning. ISMRM Workshop on Frontiers of Magnetic Resonance: From Tumor Cell to Cancer Patient, Nice, France, September 2008

21. Sudhir Pathak, Catherine Fissell, Kwan Jin Jung, and Walter Schneider. Diffusion weighted mri, comparison study of reconstruction and fiber tracking algorithms, and related tools. Organization of Human Brain Mapping, Chicago, IL, June 2007

22. Kwan-Jin Jung, Sudhir Pathak, and Walter Schneider. Further reliable detection of fiber connection through anterior and posterior commissure in diffusion tensor imaging. Organization of Human Brain Mapping, Chicago, IL, June 2007

23. Schneider W., Cole M., Goldberg R., and Pathak S. The control and representation systems of the human brain and cognition. Psychonomics, Long Beach, CA, November 2007