

Sudhir K. Pathak

MACHINE LEARNING SCIENTIST · COMPUTATIONAL MATHEMATICIAN · BIO-IMAGING SCIENTIST

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Education and Experience

Learning Research and Development Center, University of Pittsburgh

Pittsburgh, PA

RESEARCH ASSOCIATE

May 2015 - Current

- RESEARCH TOPIC: Supervised Deep-learning based diffusion MRI modeling, Physics informed neural networks for Diffusion MRI, Validation of diffusion models based on hollow textile phantoms, Ex-vivo biological diffusion model pig visual system.
- RESEARCH AREAS: Validation of diffusion models in biological tissues, Biomarkers for Traumatic Brain Injury, Diffusion MRI, Microstructural Imaging, Fiber tractography
- 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, and Validation of diffusion MRI-based models
- 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, resting-state based brain connectivity and fiber tractography
- 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: Parallel Numerical Simulation of Cardiac Electrical Activity
- AREA OF STUDY: Electro-physiology of the 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

Physics informed neural networks, Parallel Numerical algorithms, Optimization, Numerical solutions for PDE/ODE.

Computer Science

Machine/Deep learning, Javascript based 3D visualization of medical images, Multi-Variate Pattern Analysis(MVPA) on fMRI datasets.

Medical Imaging

3D-Image segmentation on Brain tissue on MRI, micro-CT datasets, Multi-model registration, Resting state fMRI connectivity, Diffusion MR Imaging, and Fiber tractography.

Data Science

Shinyapp-based Dashboard, Mathematical and Statistical Modeling, and Interactive Data Visualization.

Neuroimaging Packages

Freesurfer, FSL, AFNI, ANTS, MRTRIX, MNE-python, Osirix.

Software Skills

Computer Programming

C, C++, Python, Bash shell scripting, and CMAKE.

Numerical Analysis

R, Tidyverse (dplyr/ggplot), ShinyApp and MATLAB

Python Package

MONAI, SciPy, NumPy, Scikit-learn, Pandas, Scikit-learn, OpenCV and DiPy

Visualization Libraries/Software

VTK(.js), ITK, Paraview, CUDA, OpenGL/ES, D3.js and WebGL

Parallel/Deep-Learning Computing Libraries

PyTorch, CuPy, PETSc, FeniCS, and MPI

Current Research Projects

Eye and Hand transplant project

*Learning Research and
Development Center, University Of
Pittsburgh and UPMC*

- Developed diffusion MRI-based techniques to resolve fiber crossing and quantify white matter integrity in the Optic nerve, Optic tract, and Optic radiation using ex-vivo pig visual-system imaging on a 7T Bruker scanner.
- Designed a diffusion MRI-based tractography method to localize peripheral nervous system structures (hand, face, and leg) for limb transplant applications.
- Developed diffusion imaging protocols for both 3T and 7T scanners to optimize the visualization of the Median Nerve in the human hand.
- Conducting micro-CT imaging research on human, pig, and sheep eyes to segment fasciculus walls, providing novel insights into ocular microstructures.
- Investigating the effects of blast-induced traumatic brain injury (TBI) in sheep, where post-blast 7T MRI scans are used to identify and quantify brain damage, focusing on white matter integrity and structural alterations.

July 2015 - PRESENT

Neuroanatomical Validation of HDFT using Anisotropic Textile-based Phantom

*Learning Research and
Development Center, University Of
Pittsburgh and UPMC*

- Developed a novel and anatomically related diffusion anisotropic metric, directional axonal volume (dAV), to quantify white matter tracts.
- Led 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 the clinical scanner.
- Designed analysis processes for combining diffusion MRI-based metrics across multiple sites and multiple scanners in US and Europe.

July 2010 - PRESENT

High Definition Fiber Tracking (HDFT) and Diffusion Modeling

*Learning Research and
Development Center, University Of
Pittsburgh*

- Designed a novel mathematical diffusion model that combines diffusion spectrum imaging and Multi-shell imaging, and constrained spherical deconvolution technique.
- Combined and utilized diffusion MRI based tractography and klinger's dissection technique to map brain networks involved in language (Arcuate and SLF) and consciousness (Caudate).
- 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 technique (reducing scanning time) across major MRI scanners (Siemens, GE, and Phillips).

July 2014 - PRESENT

Clinical and Neuroscientific Application of HDFT

*Learning Research and
Development Center, University Of
Pittsburgh and UPMC*

- Formulated an algorithm for pre-surgical planning to provide and predict surgical routes that can minimize brain tissue damage during neuro-surgical 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) to visualize HDFT-based fiber tracts.
- Developed voxelwise and tract-based techniques using diffusion MRI-based anisotropic metric to track the progression of neurodegenerative diseases such as Huntington's disease and ALS.
- Identified and implemented tracts and voxelwise techniques that can relate HDFT-based structural connectivity and neuropsychological scores in stroke patients (Aphasia).
- Developed mathematical techniques (non-negative matrix factorization) and biophysical diffusion models to localize brain damage in traumatic brain injury (TBI).

July 2011 - PRESENT

Past Research Projects

Clinical Application of Magnetoencephalography (MEG)

University of Pittsburgh Medical
Center

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

July 2012 - July 2020

fMRI based Functional Connectivity

Learning Research and
Development Center, University Of
Pittsburgh

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

July 2006 - May 2010

Simulation of Cardiac Electrophysiology and Registration of Cardiac MRI

Carnegie Mellon University and
Indian Institute of Technology
Kanpur

- Simulated cardiac electrical activity using bi-domain reaction-diffusion PDF on the left ventricle of the 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.

May 2002 - May 2004

Grants

Development of HDFT-based biomarker for diagnosing of TBI and diffuse axonal injury.

Scheme for Promotion of Academic
and Research Collaboration
(SPARC2)
2023-2025

PRINCIPLE INVESTIGATOR

Amount: \$125,000

Development and Neurosurgical application of High Definition Fiber Tracking (HDFT)

Scheme for Promotion of Academic
and Research Collaboration
(SPARC1)
2020-2023

PRINCIPLE INVESTIGATOR

Amount: \$125,000

Viability, Imaging, Surgical, Immunomodulation, Ocular preservation and Neuroregeneration (VISION) Strategies for Whole Eye Transplant

The Advanced Research Projects
Agency for Health
(ARPA-H)
2025-2030

CO-PRINCIPLE INVESTIGATOR (PI: SAHEL, JOSE)

Amount: \$10,322,197

Veterans Administration Magnetic Resonance Imaging Calibration and Performance Enhancement (VA MRI CALIPER)

DSF David Scaife Foundation
Charitable Foundation

CO-PRINCIPLE INVESTIGATOR (PI: WALTER SCHNEIDER)

2025-2030

Amount: \$1,000,000

VA Quantitative Quality Assurance (VA-QQA) MRI for Brain Health CHIPS: Clinical Health Imaging Portability Standards

United State Department of
Veteran Affairs

CO-PRINCIPLE INVESTIGATOR (PI: WALTER SCHNEIDER)

2025-2030

Amount: \$688,339

Axonal and Connective Tissue Imaging (HD-ACTI) in Porcine and Human Models of Traumatic Optic Nerve Injury

CO-PRINCIPLE INVESTIGATOR (PI: WALTER SCHNEIDER)

Amount: \$655,356

High Definition Mapping of Multiscale Biomechanical Effects of Blast Trauma on Resilience of Fascicular Connective Tissue and Axonal Pathways in Optic Nerve Injury

CO-PRINCIPLE INVESTIGATOR (PI: WALTER SCHNEIDER)

Amount: \$931,391

Thalamic segmentation using advanced diffusion MR Imaging

CO-PRINCIPLE INVESTIGATOR (PI: DR. AJAY NIRANJAN)

Amount: \$50,000

Qualitative and quantitative analysis of the structure of the white matter of the human brain

CO-PRINCIPLE INVESTIGATOR (PI: DR. JUAN MIRANDA FERNANDEZ)

Amount: \$10,000

High Definition Fiber Tracking in Neurosurgery

CO-PRINCIPLE INVESTIGATOR (PI: DR. JUAN MIRANDA FERNANDEZ)

Amount: \$10,000

*Congressionally Directed Medical
Research Programs-Vision
Research Program and USAMRAA*

2025-2030

*Congressionally Directed Medical
Research Programs-Vision
Research Program and USAMRAA*

2025-2030

*International Radiosurgery
Research Foundation (IRRF)*

2021-2023

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

2011-2012

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

2010-2011

Patent

1. Anthony P Zuccolotto, John Dzikiy, Leroy K Basler, Benjamin A Rodack, Walter Schneider, and Sudhir K Pathak. MRI phantom having filaments of integral textile axon simulations and anisotropic homogeneity MRI phantom using the filaments, June 21 2022. US Patent 11,366,192
2. Walter SCHNEIDER and Sudhir PATHAK. Directional diffusion fiber tracking, September 21 2012. WO Patent 2,012,125,829 A2
3. 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

CO-INSTRUCTOR

*University of Pittsburgh
Fall 2020/2019/2018, Spring 2017/2014,
Spring 2012*

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

PSY 2476: Brain Connectivity Mapping

TEACHING ASSISTANT

*University of Pittsburgh
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

GUEST LECTURER

*Carnegie Mellon University
April 2010, April 2012*

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

Professional Activities and Awards

Associate Editor

Frontiers in Neuroscience, Frontiers in Neurology and Frontiers in Neuroimaging

Editorial Board Member

Clastrum Journal.

Editor's Choice award in Methods and Modeling

Identifying brain most globally connected regions

Best Project Award for M.Sc. thesis

Simulation of electrophysiology of Heart

University Scholarship

Indian Institute of Technology, Kanpur.

Regional Mathematical Olympiad Competition

Qualified for a regional Mathematical Olympiad Competition conducted by the regional Delhi association

Brain Imaging Methods

July 2022

Clastrum

July 2015

Neuroimage

June 2010

Mathematics Department, IIT

Kanpur

May 2004

IIT Kanpur

May 2002

Delhi Association

March 1998

Media and Special Reports

Discover Magazine: High Definition Fiber Tracking

BROKEN CABLES: HIGH-DEFINITION IMAGING HELPS RESEARCHERS MAP THE DAMAGE FROM TRAUMATIC BRAIN INJURY WITH UNPRECEDENTED ACCURACY.

Discover

September 2015

Discovery Channel: High Definition Fiber Tracking

Exploring High Definition Fiber Tracking: Physician Education, Neurology-Neurosurgery

Discovery Channel

April 2013

Gehirn und Geist Magazine: Corpus Callosum Rendering

Verbindungskabel in Kopf

Gehirn und Geist, Page 49

February 2013

Scientific American: Corpus Callosum Rendering

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

Scientific American, Page 54-55

February 2013

Neurosurgery Newsletter: Special Report on High Definition Fiber Tractography

University of Pittsburgh Medical Center, Neurosurgery Newsletter, Volume 13, Number 1

Neurosurgery Newsletter

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

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

Scientific American, Page 43

December 2011

60 MINUTES, CBS News: High Definition Fiber Tracking

60 MINUTES: Apps for Autism

CBSNEWS

October 23, 2011

Refereed Journal Publications

1. Nancy R Newlin, Kurt Schilling, Serge Koudoro, Bramsh Qamar Chandio, Praitayini Kanakaraj, Daniel Moyer, Claire E Kelly, Sila Genc, Jian Chen, Joseph Yuan-Mou Yang, et al. MICCAI-CDMRI 2023 quantconn challenge findings on achieving robust quantitative connectivity through harmonized preprocessing of diffusion MRI. *arXiv preprint arXiv:2411.09618*, 2024
2. Abdul Halim, BV Rathish Kumar, Ajay Niranjana, Aditya Nigam, Walter Schneider, Chirag K Ahuja, and Sudhir K Pathak. A colour image segmentation method and its application to medical images. *Signal, Image and Video Processing*, pages 1–14, 2023

3. Ranjeet Ranjan Jha, BV Rathish Kumar, Sudhir K Pathak, Arnav Bhavsar, and Aditya Nigam. Trganet: Transforming 3T to 7T dmri using trapezoidal rule and graph based attention modules. *Medical image analysis*, 87:102806, 2023
4. Ranjeet Ranjan Jha, BV Rathish Kumar, Sudhir KPathak, Walter Schneider, Arnav Bhavsar, and Aditya Nigam. Undersampled single-shell to MSMT fODF reconstruction using CNN-based ODE solver. *Computer Methods and Programs in Biomedicine*, 230:107339, 2023
5. Ranjeet Ranjan Jha, Sudhir K Pathak, Vishwesh Nath, Walter Schneider, BV Rathish Kumar, Arnav Bhavsar, and Aditya Nigam. VRfRNet: Volumetric ROI fODF reconstruction network for estimation of multi-tissue constrained spherical deconvolution with only single shell dMRI. *Magnetic Resonance Imaging*, 90:1–16, 2022
6. Sourabh P Bhat, BV Rathish Kumar, Shainath Ramesh Kalamkar, Vinay Kumar, Sudhir Pathak, and Walter Schneider. Modeling and simulation of the potential indoor airborne transmission of sars-cov-2 virus through respiratory droplets. *Physics of Fluids*, 34(3):031909, 2022
7. Susie Y Huang, Thomas Witzel, Boris Keil, Alina Scholz, Mathias Davids, Peter Dietz, Elmar Rummert, Rebecca Ramb, John E Kirsch, Anastasia Yendiki, et al. Connectome 2.0: Developing the next-generation ultra-high gradient strength human MRI scanner for bridging studies of the micro-, meso-and macro-connectome. *NeuroImage*, 243:118530, 2021
8. David O Okonkwo, Ross C Puffer, Davneet S Minhas, Sue R Beers, Kathryn L Edelman, Jane Sharpless, Charles M Laymon, Brian J Lopresti, Steven Benso, Ava M Puccio, et al. PET imaging of neurodegeneration in two subjects with a history of repetitive trauma and cognitive decline. *Neurotrauma Editor's Pick* 2021, 2021
9. Vishwesh Nath, Karthik Ramadass, Kurt G Schilling, Colin B Hansen, Rutger Fick, Sudhir K Pathak, Adam W Anderson, and Bennett A Landman. DW-MRI microstructure model of models captured via single-shell bottleneck deep learning. In *Computational Diffusion MRI*, pages 147–157. Springer, Cham, 2021
10. 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
11. 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
12. 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
13. 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
14. 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
15. 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
16. 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
17. Catarina Guise, Margarida M Fernandes, Joao M Nobrega, Sudhir Pathak, Walter Schneider, and Raul Fanguero.

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

18. 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 Niranjana. Magnetoencephalography-based identification of functional connectivity network disruption following mild traumatic brain injury. *Journal of Neurophysiology*, 116(4):1840–1847, 2016
19. 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
20. 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
21. 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
22. 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
23. 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
24. 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
25. Juan C Fernández-Miranda, Yibao Wang, Sudhir Pathak, Lucia Stefaneanu, 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
26. Greg Bowden, Ajay Niranjana, 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
27. 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
28. 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
29. 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
30. 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
31. 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

32. Michael W Cole, Sudhir Pathak, and Walter Schneider. Identifying the brain's most globally connected regions. *Neuroimage*, 49(4):3132–3148, 2010
33. 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
34. BV 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, 2025
2. Sudhir Pathak, Vishwesh Nath, Kurt G Schilling, Bennett A Landman, and Walter Schneider. Null-space deep learning based diffusion MR Imaging data harmonization across the scanner at multiple sites. Manuscript in preparation, 2025

Book Chapters

1. Ajay Niranjana, 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 Niranjana 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. Brian T Nixon, Sayantani Bhattacharjee, Benjamin Graybill, Constantinos Costa, Sudhir Pathak, Walter Schneider, and Panos K Chrysanthis. HealthDist: a context, location and preference-aware system for safe navigation. In *2021 22nd IEEE International Conference on Mobile Data Management (MDM)*, pages 250–253. IEEE, 2021
2. Ranjeet Ranjan Jha, Hritik Gupta, Sudhir K Pathak, Walter Schneider, BV Rathish Kumar, Arnav Bhavsar, and Aditya Nigam. Enhancing HARDI reconstruction from undersampled data via multi-context and feature inter-dependency GAN. In *2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI)*, pages 1103–1106. IEEE, 2021
3. 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
4. Walter Schneider, Sudhir Pathak, Kristofer Pomiecko, Catherine 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
5. 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

6. 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
7. 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
8. 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. Decoding the brain: Modern connectivity techniques from clinical practice to Ex-Vivo insights. School of Arts, Sciences & Business Notre Dame of Maryland University, Feb 2025
2. Sudhir Pathak. Navigating the brain's pathways: High-Definition Fiber Tracking in the treatment of tumor resection and traumatic brain injuries. School of Arts, Sciences & Business Notre Dame of Maryland University, April 2024
3. Sudhir Pathak. High Definition Fiber Tracking and its application. Centre of Behavioural and Cognitive Sciences, University of Allahabad, June 2023
4. Sudhir Pathak. High Definition Fiber Tracking and its application. Department of Radiodiagnosis, King George's Medical University, Lucknow, July 2023
5. Sudhir Pathak. Computational modeling of the human brain tissue, estimation and quantifying tissue type. Society for Mathematical Biology 2021 Annual Meeting (SMB2021), June 2021
6. 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
7. 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
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Conference Abstract and Posters

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12. 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

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