

Dr. Mohit Saxena

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I have a doctorate in Neurology specialized in Neuroimaging in movement Disorders. My doctoral study on neuro-degenerative disorders namely Parkinson's Disease (PD), Multiple System Atrophy (MSA), and Progressive Supra-nuclear Palsy (PSP) was aimed at developing suitable paradigms to pattern measure the hemo-dynamic response for speech, motor and short term memory loss. The differential BOLD brain activation pattern for the parkinsonian patients, and its significance in differential diagnosis was attempted. The extent of neuro-degeneration was ascertained using voxel based morphometry (VBM), and fiber Tractography using diffusion tensor imaging (DTI). The studies repeated after a period of 12 months evaluated the neuronal loss in the concerned brain areas, the effect of dopaminergic therapy and progress of the disease.

Current Designation:

Working as Imaging NeuroScientist at the Advanced Imaging Analytics Lab at Northwestern Medicine, Chicago IL, USA. Simultaneously Adjunct Assistant Professor of Radiology (Basic and Translational Radiology Research) at the Fienberg School of Medicine, Chicago, IL, USA.

Responsibilities:

Clinical Role: Assisting Neuro-radiologists and Neurosurgeons in pre-surgical evaluation of functional areas of brain (Functional MRI) with respect to movement and language vision and memory function in patients of various Brain tumors and Epilepsy, demonstrating connections of different Brain Areas (connectomes) using resting state and diffusion fiber tracts.

Teaching Responsibilities: Lectures at (1) **Department of Radiology**, Basic and Translational Research, Fienberg School of Medicine Northwestern University, Chicago IL, USA. (2) **Department of Biomedical Engineering**, Northwestern University, Chicago IL, USA. (Department of Radiology, **Lurie Children's Hospital**, Chicago IL, USA.

Research Role: Currently Collaborating with Clinicians and Faculties at Northwestern Medicine and Northwestern University towards MRI imaging of postoperative Deep Brain Stimulation in Parkinson's disease.

Judge: Member of editorial board for the Journal Neurology and Ophthalmology Open Access journal. I have reviewed the manuscripts for the following journals:
Human Brain mapping *Free-Water and BOLD Imaging Changes in Parkinson's disease Patients Chronically treated with a MAO-B Inhibitor*
Visual Neuroscience *Structural and white matter changes associated with duration of Braille education in early and late blind children*
Perception *Visual cortex alterations in early and late blind subjects during tactile perception*

Teaching responsibilities: Actively contributing to the educational mission of Northwestern University, Chicago IL by taking Neuroradiology Core lectures required for the resident fellows.

Recent Talks as Distinguished Speaker

Recent advances in brain imaging: At the "7th Edition of International Conference on Neurology and Neurological Disorders (Hybrid Event)" held on June 16-17, 2023 in Rome, Italy

Recent advances in brain imaging: At the 9th Edition of International Conference on Neurology and Neurological Disorders (Neurology) In Person held at Paris, France from June 20-22, 2024.

Current Collaborations:

1. **Biomedical Engineering and Radiology and (by courtesy) Electrical and Computer Engineering:**

fMRI image acquisition and data processing for patients with Deep Brain Stimulation implants.

2. **Novocure (<https://www.novocure.com/>)**

Simulation of upright CT scans from supine (lying down) CT images to utilize Tumor treating fields (TTFields) for treatment of Lung, Pancreatic and Ovarian tumors.

3. **Brainlab (<https://www.brainlab.com/>)**

Creating a workflow to develop a software that can illustrate brain connectivity maps using resting state functional MRI (rsfMRI) images for brain surgeries in patients of brain tumors, Stroke, and Epilepsy.

4. **Department of Neurosurgery**

Effect of Ultrasonication on Brain tumors using fMRI and rsfMRI

BACKGROUND

1. **MR image Analyses:** 13 years.
2. **MR Pulse sequences& Image acquisition** Good knowledge
3. **Stimulus Presentation: Superlab/E-prime**
4. **BOLD (fMRI) Image Analyses:** (Task based /Event related/Resting state), structural and Diffusion data
5. **Diffusion Imaging: Tractography in FSL, Brain Voyager and Camino**
6. **Segmentation: Cortical and subcortical**
7. **Software packages:** SPM, FSL, Free surfer, Brain Voyager, 3D Slicer and **Statistical Packages:** SPSS
8. Speech Acoustic analysis: **PRAT software**
9. **Computer Literacy:** High Performance Computing, **Ubuntu/Linux. MATLAB,** Microsoft Excel, Access, Word and PowerPoint
10. **Scripting: BASH**
11. **Teaching Experience:** >5years (Undergraduate: Biotechnology/Zoology)
12. **Writing Skills:** Scientific writing abstracts/manuscripts & Research Grants for extramural funding:
Department of Science and Technology, Government of India:
 1. Neuro-mapping of Functional Deficits Associated with Parkinsonian Disorders.
 2. Neuro-imaging Hyposmia in Movement Disorders

SKILLS

Writing: Abstracts/ Manuscripts/Research Grant/IRB/ Timely progress reports of the grants/Financial statement

Clinical: Recruitment, Scheduling and rating of Patients with PD, MSA and PSP.

Management: Patient Recruitment/Clinical Records/ MR Imaging protocol development/ fMRI experiment setup
/Data Collection and archiving/ data processing and analyses and interpretation/

Trouble-shooting: Hardware/software and other registration issues with imaging data

Others:

- Experience with Philips 3T and Siemens MRI scanners (Avanto/Verio/ Trio/Sonata) 1.5/3T
- Strong Analytical Skills
- Ability to work effectively unsupervised.
- Ability to collaborate with multiple investigators.
- Manage multiple projects
- Strong written and verbal communication skills

RESEARCH INTERESTS

- Neurodegeneration in Parkinsonism
- Cognitive Decline in Parkinsonism
- Dopaminergic effects in Parkinsonism
- Hyposmia in Parkinsonism
- Visual acuity
- Depression and attention
- Diffusion Tractography
- Volumetric differentiation
- Cortical Thickness Analyses
- Voxel based Morphometry
- Resting state MRI
- Neuromodulation in DBS implanted patients
- MR Finger printing: biomarker for early Parkinson's disease
- Evaluation of DBS stimulator settings
- Estimation of volume of tissue activated by DBS electrodes and the neuronal pathways affected
- Optimization of DBS stimulator parameter setting

PUBLICATIONS

- Tumor-associated alterations in white matter connectivity have prognostic significance in MGMT-unmethylated glioblastoma Nikhil Rammohan, Alexander Ho, **Mohit Saxena**, Amishi Bajaj, Tim J Kruser, Craig Horbinski, Alexander Korutz, Matthew Tate, Sean Sachdev. *J Neurooncol* . **2022** May 7. doi: 10.1007/s11060-022-04018-3 **Online ahead of print.**
- Patient-specific modeling of the volume of tissue activated (VTA) is associated with clinical outcome of DBS in patients with an obsessive-compulsive disorder. Fuchang Jiang, Behzad Elahi, **Mohit Saxena**, Ilknur Telkes, Marisa DiMarzio, Julie G Pilitsis, Laleh Golestanirad. *Annu Int Conf IEEE Eng Med Biol Soc*. **2021** Nov; 2021:5889-5892.PMID: 34892459. DOI: 10.1109/EMBC46164.2021.9630273.
- *CNTM-05. Left hemisphere gliomas induce a plastic bi-hemispheric language network further characterized by lobe specific glioma data.* Matthew Ramsey, Shashwat Tripathi, **Mohit Saxena**, Matthew Tate. *Neuro-Oncology*, Volume 23, Issue Supplement_6, November **2021**, Page vi225, <https://doi.org/10.1093/neuonc/noab196.903>.
- *Relevant 3D local binary pattern based features from fused feature descriptor for differential diagnosis of Parkinson's disease using structural MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S. Senthil Kumaran, R.K. Agrawal, Madhuri Behari. *Biomedical Signal Processing and Control* (34) **2017**, 134–143.
- *Voxel-based morphometry and minimum redundancy maximum relevance method for classification of Parkinson's disease and controls from T1-weighted MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S. Senthil Kumaranc, R.K. Agrawal, Madhuri Behari. December **2016** ICVGIP '16: Proceedings of the Tenth Indian Conference on Computer Vision, Graphics and Image Processing. (http://dl.acm.org/author_page.cfm?id=99658735029)
- *Graph Theory based Spectral Feature Selection for Computer Aided Diagnosis of Parkinson's Disease Using T1-weighted MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S Senthil Kumaran, Madhuri Behari, R K Agarwal. *International Journal of Imaging Systems and Technology* **06/2015**
- *Regions-of-interest based automated diagnosis of Parkinson's disease using T1-weighted MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S. Senthil Kumaranc, R.K. Agrawal, Madhuri Behari. *Expert Systems with Applications* **42 (2015) 4506–4516**.
- *Assessing Speech dysfunction using BOLD and Acoustic Analysis in Parkinsonism.* **Mohit Saxena**, Madhuri Behari, Vinay Goyal, S.Senthil Kumaran, Vaishna Narang, (**2014**). *Parkinsonism & Related Disorders: Parkinsonism and Related Disorders* **20(8) pp. 855-861**.

- **WORK EXPERIENCE:**

Research Associate Center for Neurological Restoration, Cleveland Clinic, Cleveland Ohio, USA: **December 17, 2018 to May 17, 2019**

Research Associate since at the Neuromodulation Center, Department of Neurology, School of Medicine, Cleveland Medical Center, Cleveland, OHIO, USA **Sept 1, 2018-December 16, 2018**

Post Doc Research Scholar **2014 to Aug 31, 2018**
 Neuromodulation Center, Department of Neurology, School of Medicine, Cleveland Medical Center, Cleveland, OHIO, USA, since 2014.

- *Establish a safe fMRI protocol for Post-surgery STN-DBS implant patients to determine the effect of different IPG stimulator settings on the side effects of DBS stimulation, and determine the volume of tissue activated so that diffusion Tractography can be used to observe the erroneous pathways affected*
- *MR Fingerprinting in Parkinson's disease patients where we wish to compare maps at substantia nigra level to a library of patient images.*
- *Evaluating a network difference in responders, non-responders in patients of Bipolar Disorder and healthy volunteers using Resting State fMRI.*

Senior Research Officer **2013 to 2014**

All India Institute of Medical Sciences, New Delhi, India

- Project: *Neuro-mapping Of Functional Deficits Associated With Parkinsonian Disorders*
- **Role:** Clinical recruitment, Protocol development, Image Acquisition and analyses and publication

Senior Research Associate

- Center for Biomedical Research (CBMR) - Lucknow, India

EDUCATION AND TRAINING

- **Council of Scientific and Industrial Research Junior Research Fellowship (CSIR-UGC-JRF) 2001**
- **Ph.D. Neurology** **2013**
 All India Institute of Medical Sciences, New Delhi, India
- **Master of Philosophy (M.Phil), Zoology, (Toxicology)** **1997**
 Dr Bhimrao Ambedkar University, Agra, Uttar Pradesh, INDIA
 Dissertation: *"Effect of Deltamethrin on the brain biochemistry of albino rat (Rattus norvegicus)"*
- **Master of Science, Zoology** **1996**
 University of Rajasthan, Jaipur Rajasthan, India
 Specialization Fish biology
- **Bachelor of Sciences, Life Science** **1994**
 DEI, Dayalbagh, Agra, INDIA
 Zoology Honors

ACHIEVEMENTS

Best poster award at NMRS 2009 “Effect of Dopaminergic Drugs on Motor Task in PD: An fMRI Study.
<http://www.nmrsin.org/awards.html#>

- **2nd best poster award** at XI Annual conference of Delhi Neurological Association. Feb 7-8.2009
“Cognitive deficits in working memory in Parkinson’s disease”. Mohit Saxena. S Senthil Kumaran, S Singh and M Behari.
- **MDS foreign travel grant** to attend The Movement Disorder Society's (MDS) 17th International Congress of Parkinson’s disease and Movement disorders. Sydney, Australia during 16th-20th June 2013.
- **MDS foreign travel grant** to attend The Movement Disorder Society's (MDS) 15th International Congress of Parkinson's Disease and Movement Disorders, at TORONTO, Canada, from June 5 - 9, 2011.
- **Foreign travel grant from CSIR**, India, in April 2011(Ref no. 5818).
- **MDS foreign travel grant** to attend The Movement Disorder Society's (MDS) 14th International Congress of Parkinson's Disease and Movement Disorders, in Buenos Aires, Argentina, from June 13 - 17, 2010.
- **Foreign travel grant from Department of Biotechnology, India** through its 5th Meeting held on 12th May, 2010.(reference T-5: DBT/CTEP/02/201000108)

EDITORIAL BOARD

Neurology and Ophthalmology open access Journal

Reviewer for the journals listed below:

Human Brain Mapping

Brain Connectivity

IEEE

Journal of Radiation Research

Visual Neuroscience

Perception

MEMBERSHIPS

- Member of International Parkinson's and Movement Disorders Society (**MDS**) since 2008.
- Lifetime member of National Magnetic Resonance Society (**NMRS**)
- Active Member of International Society of Magnetic Resonance in Medicine (**ISMRM**) since 2008.

INTERNATIONAL CONFERENCE PRESENTATIONS

International Society of Magnetic Resonance in Medicine (**ISMRM**)

- **2017: Honolulu, Hawaii, USA (Accepted for e-poster)**
 - fMRI in Parkinson's disease: Post STN-DBS implant.
- **2013: Salt Lake City, UT, USA**
 - Computer Aided Diagnosis of Parkinson’s disease from T1-Weighted MRI
 - Differential Diffusivity in Parkinsonism: A DTI study.
 - Short term Visual Memory Dysfunction in Parkinsonism.
- **2012: Melbourne, Australia**
 - Spectrogram and BOLD analysis of stop consonants in Parkinsonism (**Oral**)
 - Motor dysfunction in Parkinson's disease and Multiple System Atrophy and the effect of dopamine drug
- **2011: Montreal, Canada**
 - Degeneration of motor cortical areas in Parkinson's disease: A follow-up fMRI study
- **2010: Stockholm, Sweden**
 - Differential Brain Activation Pattern for a Simple Motor Task in Parkinsonism: An FMRI Study
 - Gender Dependent Response of Dopaminergic Administration in Parkinson ’s disease: A FMRI Study

- **2009: Honolulu, Hawaii, USA**
 - Effect of Dopaminergic drugs on motor and speech tasks in PD: An fMRI study.
 - An analysis of working memory in Parkinson's disease with reference to deficiency of Dopamine: An fMRI study

International Congress of Parkinson's disease and Movement Disorders (MDS)

- **MDS 2015: San Diego, California, USA**
 - Imaging neurodegeneration in Movement Disorders: A VBM study
- **MDS 2013: Sydney Australia**
 - Bold Imaging: Following Neuro-degeneration In Movement Disorders
- **MDS 2012: Dublin, Ireland**
 - Dysarthria in Parkinsonism: Neural or articulatory
 - Diffusion Tensor Imaging and Fiber Tractography in Movement Disorders
- **MDS 2011: Toronto, Canada**
 - Comparison of memory recall in parkinsonian patients: An FMRI study
- **MDS 2010: Buenos Aires, Argentina**
 - Articulatory dysfunction in Parkinson's disease: An fMRI study
 - Effect of Levodopa on the working memory in Parkinson's disease: An fMRI study
 - Can BOLD brain activation pattern differentiate the different classes of parkinsonism for a simple motor task
 - Is L-Dopa response in Parkinson's disease gender dependent? An fMRI study

International symposium on cellular and molecular basis of brain plasticity and repair mechanism 2010

- Functional Imaging for Motor and Speech task in Parkinsonism
- **AOPMC 2009: New Delhi, India**
 - Articulatory Dysfunction in Parkinson's disease: An fMRI study

NATIONAL CONFERENCE PRESENTATIONS

National Magnetic Resonance Society (NMRS)

- **2012**
 - Dysarthria in Parkinsonism: Neural or articulatory?
- **2011**
 - Bold Mapping of Memory Recall in Parkinson's Patients
- **2010**
 - Is Dopaminergic administration in Parkinson's disease gender dependent? An fMRI study
 - Differentiating the three classes of Parkinsonism using BOLD imaging for a simple motor task
 - Articulatory dysfunction in Parkinson's disease: An fMRI study. Effect of sad emotions on speech in depressed and non-depressed Parkinson's disease patients: An fMRI study
 - Areas activated within the brain in response to sadness evoking videos in depressed and non-depressed Parkinson's disease patients
- **2009**
 - Cognitive deficits in working memory in Parkinson's disease
 - Effect of Dopaminergic drugs on motor task in PD: An fMRI study
 - Role of stop consonants in articulatory speech dysfunction in Parkinson's disease using fMRI
- **2011 Asian Biophysical Association (ABA/IBS)**
 - Functional Imaging for Motor and Speech task in Parkinsonism

COVER LETTER

I have a PhD in Neurology from AIIMS, New Delhi, India with expertise in NeuroImaging (eg fMRI, DTI, rsfMRI etc.) with around 15 years of experience in MR Image Processing, apart from creating fMRI experiments in ePrime/ etc. I have also worked in creating a safe fMRI protocol for postop DBS implanted patients while I was a Postdoc at University Hospitals, Cleveland Medical Center, Cleveland Ohio, USA.

I have been working with:

ePrime: stimulus presentation

fMRI: SPM, FSL

DTI: fsl, Camino MRTRIX etc

Currently, I am working as an advanced Imaging Neuroscientist at Northwestern Medicine, Chicago IL. Also, being Adjunct Assistant Professor at the Department of Radiology (at Feinberg School of Medicine Northwestern University, Chicago IL), I am collaborating with research groups that do the following research:

1. post op DBS research where we determine the volume of tissue activation by different DBS stimulation settings and mapping the DBS targets for OCD and Bipolar Disorder patients.
2. Glioma Research
3. Developing a tool with Brainlab for resting state analyses

I process fMRI and DTI to help Neurosurgeons and Epileptologists in 3D Image analyses and fusions (MR/CT/PET/MEG/EEG/BrainLab) apart from processing CSF flow, perfusion, Spectroscopy data etc.

Research Focus

Currently I am working as an advanced Imaging neuroscientist, where my responsibilities are to provide MR imaging postprocessing clinical support for the Radiologists, neurologists, neurosurgeons and epileptologists. This includes fusion (registration) of multimodality imaging data, 3D reconstruction of DTI/fMRI and rsfMRI datasets, perfusion and spectroscopy data analyses.

My research interests are:

(1) **Post op DBS research (fMRI/DTI/Cognitive):** I am interested in Calculation of volume of tissue activated in response to DBS stimulation and using those volume try to find the tracts passing through those and the thalamus/Gpi in Parkinson's disease/ Dystonia or Nucleus accumbens in OCD patients or Anterior cingulate Gyrus in Bipolar disorder patients. As a Postdoc at the University Hospitals Cleveland Medical Center (UHCMC) Cleveland Ohio, I had worked towards developing an MR Imaging protocol for safe image acquisition in Parkinson's disease patients who had been implanted with Deep Brain Stimulation electrodes. I continue this work at Northwestern Medicine and is currently trying to establish the effects and side effects of DBS stimulation on different Brain functions using fMRI in patients of Parkinson's disease, Obsessive compulsive disorders (OCD) and Dystonia (7).

(2) **Functional Anatomy of Human speech:** Using neuroimaging, the degree of speech dysfunction in Parkinsonism could be an important clue in early differential diagnosis in Parkinsonism as published in the article (1). Further, using MRI images from a carefully categorized patient population, I have helped the researchers from other academic institutes develop a machine learning algorithm (based on intensities on MR images) that could detect significant changes in the brain structure and present a computer aided diagnosis (2-5).

I have a Ph.D in Neurology from All India Institute of Medical Sciences, (AIIMS) New Delhi, India. During which I tried to differentiate the variants of Parkinsonism (Parkinson's disease **(PD)**, Multiple system atrophy **(MSA)**, Progressive supranuclear palsy **(PSP)**). My research question aimed at differentiating these disorders, using MRI images from the clinical MRI Scanner. Apart from the etiology and treatment of these movement disorders, I gained an understanding of the basic principles of MRI physics and how those MR image acquisition parameters can be modified to obtain MRI images from patient brains to help in creating better diagnostic imaging especially **fMRI experiments** for various tasks like speech, movement, memory etc) indicative of brain malfunctioning in such patients as compared to healthy individuals.

Being an Advanced Imaging Neuroscientist at Northwestern Medicine Hospital, Chicago I am also helping the Neurosurgeons and Epileptologists and Neurologists in preserving the brain areas that are still functional (within the tumor/epilepsy) and their connections to other [parts of the brain as indicated by the fMRI procedures conducted on these patients. I have also developed workflows which allow surgeons to predict and define the trajectory of surgical procedures (8). Also the physicians and Surgeons can view medical images from all platforms such as MRI, CT, PET, SPECT, MEG, EEG etc overlaid as layers on the same brain.

I have presented my neuroimaging results at many international conferences from time to time and published in reputed journals.

1. *Assessing Speech dysfunction using BOLD and Acoustic Analysis in Parkinsonism.* Mohit Saxena, Madhuri Behari, Vinay Goyal, S.Senthil Kumaran, Vaishna Narang, (2014). *Parkinsonism & Related Disorders: Parkinsonism and Related Disorders* 20(8) pp. 855-861.
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3. *Graph Theory based Spectral Feature Selection for Computer Aided Diagnosis of Parkinson's Disease Using T1-weighted MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S Senthil Kumaran, Madhuri Behari, R K Agarwal. *International Journal of Imaging Systems and Technology* 06/2015
4. *Voxel-based morphometry and minimum redundancy maximum relevance method for classification of Parkinson's disease and controls from T1-weighted MRI.* Bharti Rana, Akanksha Juneja, **Mohit Saxena**, Sunita Gudwani, S. Senthil Kumaranc, R.K. Agrawal, Madhuri Behari. December 2016 ICVGIP '16: Proceedings of the Tenth Indian Conference on Computer Vision, Graphics and Image Processing. (http://dl.acm.org/author_page.cfm?id=99658735029)
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6. Tumor-associated alterations in white matter connectivity have prognostic significance in MGMT-unmethylated glioblastoma Nikhil Rammohan, Alexander Ho, **Mohit Saxena**, Amishi Bajaj, Tim J Kruser, Craig Horbinski, Alexander Korutz, Matthew Tate, Sean Sachdev. *J Neurooncol* . 2022 May 7. doi: 10.1007/s11060-022-04018-3 **Online ahead of print.**
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8. *CNTM-05. Left hemisphere gliomas induce a plastic bi-hemispheric language network further characterized by lobe specific glioma data.* Matthew Ramsey, Shashwat Tripathi, **Mohit Saxena**, Matthew Tate. *Neuro-Oncology*, Volume 23, Issue Supplement_6, November 2021, Page vi225, <https://doi.org/10.1093/neuonc/noab196.903>.