

Aditya RASTOGI

Post Doctoral Scholar | Kopfklinik | Universitätsklinikum Heidelberg

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My research interests are computational methods in medical imaging, parameter estimation from dynamic magnetic resonance imaging, namely DCE-MRI and ASL, multi-modal imaging, medical image reconstruction techniques, and physiological modelling of pathologies.

EDUCATION

- Aug 2018 -** M.Tech (Research) + Ph.D. in Computational and Data Sciences, from **Indian Institute of Science (IISc)**, Bengaluru, India
- June 2022** Advisor : Prof. Phaneendra K Yalavarthy **CGPA: 9.0**
Dissertation : *Development of Novel Deep Learning Methods for Fast-MRI: Anatomical Image Reconstruction to Quantitative Imaging.*
- Aug 2012 -** B.Tech in Mechanical Engineering, from **Delhi Technological University**, New Delhi, India
- July 2016** Advisor : Prof. Atul Kumar Agrawal **CGPA: 8.86**
Dissertation : *Computational modelling of Composite dynamics and fabrication techniques.*

POSITION

- June 2021 -** **Post Doctoral Scholar | Kopfklinik, UNIVERSITÄTSKLINIKUM HEIDELBERG (UKHD), Heidelberg, Germany**
- > Deploy Federated Learning framework for Tumor Classification and predicting stroke outcome.
 - > Developing model-based deep learning algorithm for MR image reconstruction.
- Federated Learning MR Image Reconstruction

RESEARCH PROJECTS

VALIDATE: FEDERATED LEARNING FOR STROKE OUTCOME PREDICTION

POSTDOC, UKHD

[Website](#)

AUGUST 2021 -

- > **Objective** : To develop a trustworthy AI-based prognostic tool for predicting patient outcomes in Acute Stroke.
- > **Method** : Use an open-source Federated Learning library to train a neural network which uses multi-modal imaging and clinical data.

Deep Learning Federated Learning

GREYBOX : A HYBRID ALGORITHM FOR DIRECT ESTIMATION OF TRACER KINETIC PARAMETERS

PH.D., IISc

Under Review

FEB 2021 -

- > **Objective** : To propose a hybrid deep learning model for solving nonlinear multiparametric inverse problem of permeability estimation.
- > **Method** : Implemented direct hybrid DL based algorithms for parameter estimation using linear Patlak model on multi organ DCE MRI data. The experiments shows that the network performs statistically better than iterative direct parameter estimation techniques.

Inverse problem DCE MRI Deep Learning Quantitative MRI Hybrid models Compressive Sensing

VTDC-NET : A SPATIO-TEMPORAL DIMENSION INVARIANT NETWORK FOR ESTIMATION OF TRACER KINETIC PARAMETERS

PH.D., IISc

[Github repository](#) [Paper](#)

JULY 2021 - NOV 2022

- > **Objective** : To propose a spatio-temporal invariant deep learning model for direct estimation of tracer kinetic parameters.
- > **Method** : Proposed a deep learning algorithm which is invariant to the number of time samples by using a 2.5 D Unet architecture. This work is published [3] in **Medical Physics** journal.

Inverse problem DCE MRI Deep Learning Quantitative MRI

SPINET : A MODEL BASED DL ARCHITECTURE FOR SOLVING INVERSE PROBLEMS

PH.D., IISc

[Github repository](#) [Paper](#)

FEB 2020 - FEB 2021

- > **Objective** : To develop a model based DL architecture for solving linear inverse problems in medical imaging.
- > **Method** : Developed a Schatten p-norm regularized medical image reconstruction architecture or **Spinet**. This architecture is first of a kind DL architecture which can enforce any l_p norm on prior where $p \in [0, 2)$ and it can be trainable or fixed. Current architectures only support either 1 norm or 2 norm on prior. This work is published [2] in **Medical Physics** journal.

Inverse problem Fast MRI Deep Learning Hybrid models Compressive Sensing

TRACER KINETIC PARAMETER ESTIMATION FROM UNDERSAMPLED DCE MRI DATA

PH.D., IISc

[Github repository](#) [Paper](#)

AUG 2019 - AUG 2020

- > **Objective :** To estimate permeability parameters from undersampled Dynamic Contrast Enhanced MRI data by implementing linear and non-linear pharmacokinetic models using iterative and deep learning based techniques.
- > **Method :** Implemented indirect DL based and direct iterative algorithms for parameter estimation using linear Patlak model on Breast DCE MRI data. The study showed that for higher undersampling rates, indirect DL based techniques perform sub-par compared to direct iterative techniques. This work is published [1] in **Medical Physics** journal.

Inverse problem DCE MRI Deep Learning Quantitative MRI Hybrid models Compressive Sensing

REDUCING SCAN TIME IN ARTERIAL SPIN LABELLING MRI

PH.D., IISc

DEC 2020 -

- > **Objective :** Reduce the number of Control/Label pair acquisition for perfusion estimation in psuedo continuous ASL brain image scans and thereby reduce the scan duration.
- > In collaboration with National Institute of Mental Health and Allied Sciences (**NIMHANS**).

Inverse problem ASL Quantitative MRI Hybrid models

FUSION OF CARDIAC ANGIOGRAPHY IMAGES

PH.D., IISc

JAN 2019 - AUG 2019

- > **Objective :** Fusion of Cardiac Angiography images of different RR phases using guided image fusion. The ECG data was used to detect the phases with less motion of right coronary artery. The objective is to reduce the number of study images required by the diagnostician for detecting stenosis in RCA or LDA.
- > In collaboration with Shri Satya Sai Institute of Higher Medical Sciences, Bangalore (**SSSIHMS**).

Image Fusion Cardiac Imaging Guided Filtering

AWARDS

PMRF 2020



Prime Minister's Research Fellowship

Awarded Prime Minister's Research Fellowship (PMRF) for research in the field of "advanced physics based DL algorithms for medical image reconstruction". **This is the most prestigious and selective grant awarded by Government of India to Ph.D. students.**

EECS 2021



Best research presentation award

Awarded presentation award for **SpiNet** paper at EECS students research symposium - 2021 organised by Indian Institute of Science.

MHRD 2018-2020



Ph.D Grant by Ministry of Human Resource and Development

Awarded MHRD scholarship by Government of India for Ph.D. program.

RELEVANT COURSES

ML/DL/Mathematics	Neural Networks and Learning Systems, Numerical Optimization, Numerical Methods, Numerical Linear Algebra, Computational Fluid Dynamics, and Quantitative Techniques.
Others	Medical Imaging, Digital Signal Processing, Advance Image Processing, Instrumentation and Control Systems, Compressive Sensing and Sparse Signal Processing.

TEACHING ASSISTANCE

- > DS 288: Numerical Methods CDS, IISc
 - > DS 260: Medical Imaging CDS, IISc
 - > DHIM: Advance Certification in Digital Health and Medical Imaging CDS, IISc
 - > Class - XI Biology Kendriya Vidyalaya, IISc
- Teacher volunteer for **high-school** students under Prime Minister's Research Fellowship Scheme

RESEARCH GRANT EXPERIENCE

Aug 2020 - Aug 2024	Prime Minister's Research Fellowship : Awarded by Ministry of Human Resource Development of Government of India for research in the field of interdisciplinary sciences. The grant duration is of four years with a total grant amount of approximately INR 58,00,000 (\$79,000). The grant was awarded for research in the field of " advanced physics based DL algorithms for medical image reconstruction ".
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</> COMPUTER SKILLS

- > **Programming Languages** : MATLAB, C, Python, HTML
- > **Libraries** : Keras, Tensorflow, Git
- > **OS** : Windows, Linux, MacOS

✓ REVIEWER WORK

- > IEEE Transactions of Medical Imaging

📁 JOURNAL PUBLICATIONS

- [1] **Aditya Rastogi and Phaneendra K. Yalavarthy**, “Comparison of iterative parametric and indirect deep learning-based reconstruction methods in highly undersampled DCE-MR Imaging of the breast,” *Medical Physics* 47(10), 4838-4861 (2020). [doi: 10.1002/mp.14447]. [This work is the first comprehensive comparison of compressive sensing reconstruction methods with model-based deep learning methods for breast perfusion imaging and shows that deep learning methods are sub-optimal at higher undersampling rates.] [Github repository](#) [Paper](#)
- [2] **Aditya Rastogi and Phaneendra K. Yalavarthy**, “SpiNet: A Deep Neural Network for Schatten p -norm Regularized Medical Image Reconstruction,” *Medical Physics* 48(5), 2214-2229 (2021). [doi: 10.1002/mp.14744]. [This work is the first-of-its-kind in proposing a generic Schatten p -norm ($0 < p \leq 2$) regularization based deep learning network for medical image reconstruction, where p is a trainable parameter (chosen automatically).] [Github repository](#) [Paper](#)
- [3] **Aditya Rastogi, Arindam Dutta and Phaneendra K. Yalavarthy**, “VTDCNet: A spatio-temporal dimension invariant network for direct estimation of tracer kinetic parameters from undersampled DCE MRI data,” *Medical Physics* 2022;1-13. [doi: 10.1002/mp.16081]. [This is deep learning based architecture for direct estimation of permeability parameters from undersampled DCE MRI data. This network is invariant to number of time samples and spatial dimensions.] [Github repository](#) [Paper](#)
- [4] **Aditya Rastogi and Phaneendra K. Yalavarthy**, “Greybox: A hybrid algorithm for direct estimation of tracer kinetic parameters from undersampled DCE MRI data,” *Medical Physics* (Under review, Manuscript ID:22-2167). [This work proposes a robust hybrid algorithm for solving a multiparametric non-linear inverse problem of direct estimation of Pharmacokinetic parameters from undersampled DCE MRI data.]

📄 TALKS/PRESENTATIONS

IISc EECS RESEARCH STUDENT SYMPOSIUM Title : “Model based deep learning architecture for generalized p -norm regularization”	IISc May 2021
CDS STUDENTS’ RESEARCH PRESENTATION Title : “Fast and Efficient Algorithms for Improving Magnetic Resonance Imaging”	IISc April 2021
IPWIN2021: VIRTUAL PHD WINTER SCHOOL AT DTU, DENMARK Title : “Fast and Efficient Algorithms for Improving Magnetic Resonance Imaging”	DTU Jan 2021
CDS STUDENTS’ RESEARCH PRESENTATION (POSTER PRESENTATION) Title : “Model based techniques for indirect Tracer Kinetic parameter estimation”	IISc August 2019

“ REFERENCES

Prof. Dr. med. Philipp Vollmuth

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