Raghav Mehta

Email: raghav.11393@gmail.com **Website:** https://ragmeh11.github.io

Research Interest

Image Analysis (Medical Imaging, Computer Vision) & Machine Learning (Deep Learning, Bayesian Deep Learning, Causal Learning, Fair and Trustworthy AI)

Education

Ph.D., Electrical and Computer Engineering Sep. 2017 – July 2023
McGill University *Montreal, Canada*
- **Thesis**: Integrating Bayesian Deep Learning Uncertainties in Medical Image Analysis
- **Advisor**: Prof. Tal Arbel

M.S. by Research, Electronics and Communication Engineering Aug. 2014 – July 2017
International Institute of Information Technology - Hyderabad (IIIT-H) *Hyderabad, India*
- **Thesis**: Population specific template construction and brain structure segmentation using deep learning methods
- **Advisor**: Prof. Jayanthi Sivaswamy

B.E., Electronics Engineering July 2010 – May 2014
Gujarat Technological University (GTU) *Ahmedabad, India*
- **Thesis**: Smart Washing Machine using Fuzzy Logic Control System
- **Advisors**: Prof. Vithal N. Kamat and Prof. D. M. Patel

Research Experience

Imperial College London Feb. 2024 – Present
Research Associate (PostDoc) *London, UK*
- **PI**: Prof. Ben Glocker
- Working on Responsible AI (Uncertainty, Fairness, and Causality) for Medical Image Analysis.
- Part of AI-POD project (Building Trustworthy tools to predict cardiovascular disease).
- Mentoring 1 master's and 1 PhD student.

Meta Inc. July 2022 – Dec. 2022
Research Scientist Intern *Menlo Park, USA*
- **Supervisors**: Dr. Ivan Evtimov and Dr. Tal Hassner
- Worked on robustness and fairness of foundational models. Developed new learning strategies for improving robustness to spurious correlations and improving fairness.
- Led to two publications in ECCV 2022 and ICCV 2023 workshops.

McGill University & MILA AI Institute Sept. 2017 – Aug. 2023
Graduate Research Assistant *Montreal, Canada*
- Worked on Bayesian Deep Learning techniques for medical image analysis on real-world clinical neuroimaging datasets.
- Led to 15 publications including 8 first-author papers.
- Mentored 2 master's thesis.

International Institute of Information Technology - Hyderabad (IIIT-H) Jan. 2015 – July. 2017
Graduate Research Assistant *Hyderabad, India*
- Worked on machine learning techniques for neuroimage analysis.
- Led to 5 publications including 3 first-author papers.
- Worked on a prestigious project on constructing an Indian human brain MR atlas for the young population, which was covered by various news outlets in India [Ex. Zee News, The Hindu, India Today].

Teaching Experience

McGill University Sep. 2019 – Apr. 2022
Graduate Teaching Assistant *Montreal, Canada*

- Worked as a Teaching Assistant for six semesters (Fall 2019, Winter 2020, Fall 2020, Winter 2021, Fall 2021, Winter 2022) for the course on Introduction to Computer Vision.
- Delivered tutorials, designed assignments, and projects.
- **Lecturers:** Prof. Tal Arbel and Prof. James J. Clark

International Institute of Information Technology - Hyderabad (IIIT-H) Aug. 2016 – Nov. 2016
Graduate Teaching Assistant *Hyderabad, India*

- Worked as a Teaching Assistant for the course on Medical Image Processing.
- Delivered tutorials, designed assignments, and projects.
- **Lecturer:** Prof. Jayanthi Sivaswamy

Awards

Best Paper Award

- FAIMI workshop MICCAI-2023: Best Oral Presentation Paper
- MICCAI 2023: Top-10 paper (STAR award)
- DART workshop MICCAI-2021: Best paper award
- UNSURE workshop MICCAI-2019: Best paper award

Outstanding Reviewer

- MIDL 2024 – One of 26 review awardees out of a total of 300 reviewers.
- MIDL 2022 – One of 23 review awardees out of a total of 200 reviewers.
- MIDL 2021 – One of 9 review awardees out of a total of 200 reviewers.

Academics

- Best Departmental Ph.D. thesis at Electrical and Computer Engineering, McGill University
- MEITA Scholarship – McGill Engineering International Doctoral Award, 2017-2020. (Selective)
- GREAT Travel Award 2018/19 - McGill University to attend MICCAI-2018. (Selective)
- GMA Travel Award 2018/19 - McGill University to attend Summer School on Deep Learning And Bayesian Methods - DeepBayes 2018. (Selective)
- Financial Aid for Research Assistantship at IIIT-Hyderabad - Funded by the prestigious Department of Science and Technology, Govt. of India, under Grant SR/CSRI/194/2013(G).

Press

Construction of 1st Indian Human Brain MR Atlas

- **India Today:** Indians have smallest brains in the world, reveals IIIT-Hyderabad study after creating brain atlas
- **The Hindu:** Indian brain is smaller': IIIT-Hyderabad researchers create Indian Brain Atlas
- **Zee News:** IIIT-H researchers create first-ever Indian Brain Atlas
- **Times Now:** IIIT Hyderabad researchers create first-ever Indian Brain Atlas: What is it?
- **GeoNews:** Indians have smallest brains in the world: research
- **The Economic Times:** Indians have smaller brains compared to Caucasians and Chinese: Study
- **Business Today:** Indian brain size is smaller! Hyderabad researchers make remarkable finding

Publications (🎓):

- Published in the top Journals and Conferences.
- Total articles published: **20+** in 10 years of research in Machine Learning and Medical Image Analysis.
- Total Citation: **600+** with H-Index: 11

Under Preparation

1. J. Durso-Finley, J.P. Falet, **R. Mehta**, D. L. Arnold, N. Pawlowski, T. Arbel.
   Improving Image-Based Precision Medicine with Uncertainty-Aware Causal Models
   Medical Image Analysis (MedIA) journal.

2. A. Kumar, N. Fathi, **R. Mehta**, B. Nichyporuk, J.P. Falet, S. Tsaftaris, T. Arbel.
   Debias & Explain: Discovering Unbiased and Fair Image Markers Via Counterfactual Image Generation.
   IEEE Transactions on Medical Imaging (TMI) journal..

Peer Reviewed Journals Publications

1. B. Nichyporuk, J. Cardinell, J. Szeto, **R. Mehta**, J.P. Falet, D. Arnold, S. Tsaftaris, T. Arbel.
   Rethinking Generalization: The Impact of Annotation Style on Medical Image Segmentation
   Machine Learning for Biomedical Imaging (MELBA) journal.

2. **R. Mehta**, A. Filos, U. Baid, ..., S. Bakas, Y.Gal, T. Arbel.
   QU-BraTS: MICCAI BraTS 2020 Challenge on Quantifying Uncertainty in Brain Tumor Segmentation - Analysis of Ranking Metrics and Benchmarking Results.
   Machine Learning for Biomedical Imaging (MELBA) journal.

3. **R. Mehta**, T. Christinck, T. Nair, A. Bussy, S. Premasiri, M. Constantino, M. Chakravarty, D. Arnold, Y. Gal, T. Arbel.
   Propagating Uncertainty Across Cascaded Medical Imaging Tasks for Improved Deep Learning Inference.
   IEEE Transactions on Medical Imaging (TMI), September 2021. (IF: 10.04)

4. J. Sivaswamy, A. Thottupattu*, **R. Mehta***, R. Sheelakumari, C. Keshavdas.
   Construction of Indian Human Brain Atlas.
   Neurology India Journal, 2019. (IF: 2.17)

5. **R. Mehta**, A. Majumdar, J. Sivaswamy.
   BrainSegNet: a convolutional neural network architecture for automated segmentation of human brain structures.
   SPIE Journal of Medical Imaging (JMI), 2017. (IF: 3.61)

Peer Reviewed Conferences Publications

1. C. Shui*, J. Szeto*, **R. Mehta**, D. L. Arnold, T. Arbel.
   Mitigating Calibration Bias Without Fixed Attribute Grouping for Improved Fairness in Medical Imaging Analysis
   Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2023.
   (Early Acceptance - Top 15%)

2. J. Durso-Finely, J. P. Falet, **R. Mehta**, D. L. Arnold, N. Pawlowski, T. Arbel.
   Improving Image-Based Precision Medicine with Uncertainty-Aware Causal Models
   Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2023.
   (Shortlisted for MICCAI Best Paper Award – top 1%)

3. **R. Mehta**, C. Shui, T. Arbel.
Evaluating the Fairness of Deep Learning Uncertainty Estimates in Medical Image Analysis
Medical Imaging with Deep Learning (MIDL) conference 2023.

4. S. Vadacchino, **R. Mehta**, N.M. Sepahvand, B. Nichyporuk, J. Clark, T. Arbel.
HAD-Net: A Hierarchical Adversarial Knowledge Distillation Network for Improved Enhanced Tumour Segmentation Without Post-Contrast Images
Medical Imaging with Deep Learning (MIDL) conference 2021.

5. **R. Mehta**, A. Filos, Y. Gal, T. Arbel.
Uncertainty Evaluation Metric for Brain Tumour Segmentation
Medical Imaging with Deep Learning (MIDL) conference 2020.
Short Paper Oral Presentation

6. **R. Mehta**, J. Sivaswamy.
M-net: A Convolutional Neural Network for deep brain structure segmentation.
IEEE International Symposium on Biomedical Imaging (ISBI) 2017
Oral Presentation (Acceptance Rate: **20%**)

7. **R. Mehta**, J. Sivaswamy.
A hybrid approach to tissue-based intensity standardization of brain MRI images.
IEEE International Symposium on Biomedical Imaging (ISBI) 2016

Peer Reviewed Workshops Publications

1. A. Kumar, N. Fathi, **R. Mehta**, B. Nichyporuk, J. P. Falet, S. Tsaftaris, T. Arbel.
Debiasing Counterfactuals In the Presence of Spurious Correlations
Fairness of AI in Medical Imaging (FAIMI) Workshop – Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2023.
(Best oral presentation award) – Oral Presentation

2. V. Albiero, **R. Mehta**, I. Evtimov, S. Bell, L. Sagun, A. Markosyan.
Confusing Large Models by Confusing Small Models
Out Of Distribution Generalization in Computer Vision (OOD-CV) Workshop – International Conference on Computer Vision (ICCV) 2023.
Oral Presentation

3. **R. Mehta**, V. Albiero, L. Chen, I. Evtimov, T. Glaser, Z. Li, T. Hassner.
You Only Need a Good Embeddings Extractor to Fix Spurious Correlations
Workshop on Responsible Computer Vision (RCV) – European Conference on Computer Vision (ECCV) 2022
Oral Presentation.

4. **R. Mehta**, C. Shui, B. Nichyporuk, T. Arbel.
Information Gain Sampling for Active Learning in Medical Image Classification
Workshop on Uncertainty for Safe Utilization of Machine Learning in Medical Imaging (UNSURE) – Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2022.

5. B. Nichyporuk, J. Cardinell, J. Szeto, **R. Mehta**, D. Arnold, S. Tsaftaris, T. Arbel.
Cohort Bias Adaptation in Aggregated Datasets for Lesion Segmentation
Domain Adaptation and Representation Transfer (DART) 2021 workshop - Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2021.
(Best paper award) – Oral Presentation

6. **R. Mehta***, T. Christinck*, T. Nair, P. Lemaitre, D. Arnold, T. Arbel.
Propagating Uncertainty Across Cascaded Medical Imaging Tasks for Improved Deep Learning Inference
Workshop on Uncertainty for Safe Utilization of Machine Learning in Medical Imaging (UNSURE) – Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2019.
(Best paper award) – Oral Presentation

7. B. Kaur, P. Lemaitre, **R. Mehta**, N.M. Sepahvand, D. Precup, D. Arnold, T. Arbel.
Improving Pathological Structure Segmentation Via Transfer Learning Across Diseases
Workshop on Domain Adaptation and Representation Transfer (DART): Learning Transferable, Interpretable, and Robust Representation – Medical Image Computing and Computer Assisted Intervention (MICCAI) 2019.
Oral Presentation

8. **R. Mehta**, T. Arbel.
RS-Net: Regression-Segmentation 3D CNN for Synthesis of Full Resolution Missing Brain MRI in the Presence of Tumours
Workshop on Simulation and Synthesis in Medical Imaging (SASHIMI) – Medical Image Computing and Computer Assisted Intervention (MICCAI) 2018.
Oral Presentation

9. A. Majumdar*, **R. Mehta***, J. Sivaswamy.
To Learn or Not to Learn Features for Deformable Registration?
Workshop Deep Learning Fails (DLF) – Medical Image Computing and Computer Assisted Intervention (MICCAI) 2018.
Oral Presentation

International Conference Challenge (Benchmarks) Proceedings

1. **R. Mehta**, T. Arbel.
3D U-net for Brain Tumour Segmentation
Multimodal Brain Tumour Segmentation (BraTS) challenge 2018 – Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2018.

2. A. Kriz, **R. Mehta**, B. Nichyporuk, T. Arbel.
Exploring Compound Loss Functions for Brain Tumor Segmentation
Multimodal Brain Tumour Segmentation (BraTS) challenge 2023 – Medical Image Computing and Computer Assisted Intervention (MICCAI) conference 2023.

Refereed Short Paper Contributions

1. **R. Mehta**, T. Arbel.
RS-Net: Regression-Segmentation 3D CNN for Synthesis of Full Resolution Missing Brain MRI in the Presence of Tumours
Workshop on Medical Imaging meets NeurIPS (Med-NeurIPS) – NeurIPS 2018.

ArXiv Preprint

1. J. Sivaswamy, A. Thottupattu*, Mythri V.*, **R. Mehta**, R. Sheelakumari, C. Keshavdas.
Sub-cortical structure segmentation databse for young population.
arXiv preprint arXiv:2111.01561, 2021

2. S. Bakas, M. Reyes, ..., T. Arbel, ..., **R. Mehta**, ..., B. Menze.
"Identifying the Best Machine Learning Algorithms for Brain Tumor Segmentation, Progression Assessment, and Overall Survival Prediction in the BRATS Challenge"
arXiv preprint arXiv:1811.02629, 2018

Academic Service and Leadership

Organizing Committee

- UNSURE workshop (Uncertainty for Safe Utilization in Medical Imaging)
  - MICCAI 2022
  - MICCAI 2023
  - MICCAI 2024
- QU-BraTS challenge (Quantification of Uncertainty in Brain Tumour Segmentation)
  - MICCAI 2019
  - MICCAI 2020

Session Chair

- Medical Imaging and Deep Learning (MIDL) 2021

Technical Reviewer

- CVPR: Computer Vision and Pattern Recognition conference 2024
- MIDL: Medical Imaging and Deep Learning conference 2020-2024
- MICCAI: Medical Imaging Computing and Computer Assisted Intervention conference 2020-2024
- NeurIPS: Neural Information Processing Systems conference 2022
- ICLR: International Conference on Learning Representations 2022
- MedIA: Medial Image Analysis Journal 2022
- MELBA: The Journal of Machine Learning for Biomedical Imaging 2021-2024
- TMI: Transactions on Medical Imaging 2019-2020
- TUFFC: Transactions on Ultrasonics, Ferroelectrics, and Frequency Control 2020
- FN: Frontiers of NeuroImaging journal. 2020
- NI: Elsevier NeuroImage journal 2021

Miscellaneous

- Lab coordinator during the 1st Machine Learning Summer School at IIIT-Hyderabad. 2017
- Lab Head during the Fair Federated AI (FIFAI) Summer School. 2024

Industry Collaboration and Software License:

- Automatic Segmentation of Healthy Tissues and Tumours in Patient Brain Images using 3D Fully Convolutional Neural Networks. McGill University & Synaptive Medical Inc.

Invited Talks

- *Explainable AI and its application in Healthcare* 23/09/2023
  Nirma University, Ahmedabad, Gujarat, India. Invited By: Prof. Rupal Kapdi
- *Towards Trustworthy AI for Medical Image Analysis* 21/09/2023
  GE Healthcare, Bangalore, Karnataka, India. Invited By: Dr. Sudhanya Chatterjee
- *Towards trustworthy machine learning models for medical image analysis* 23/08/2023
  Cornell Tech, New York, NY, USA. Invited By: Prof. Mert Sabuncu
- *Towards trustworthy machine learning models for medical image analysis* 21/08/2023
  A.A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA. Invited By: Prof. Adrian Dalca
- *Towards trustworthy models for Medical Image analysis* 21/07/2023
  Imperial College London, London, UK. Invited By: Prof. Ben Glocker

- *Towards Trustworthy and Fair Medical Image Analysis Models* 15/05/2023
  Centre for Visual Information Technology (CVIT) seminar series, International Institute of Information Technology (IIIT) - Hyderabad, India. Invited By: Prof. Jayanthi Sivaswamy

- *Towards Trustworthy and Fair Machine Learning Models: A medical image analysis study* 17/03/2023
  Meta Inc., Menlo Park, CA, USA. Invited By: Dr. Tal Hassner

- *Towards Trustworthy and Fair Medical Image Analysis Models* 16/03/2023
  John Hopkins University (JHU), Baltimore, MD, USA. Invited By: Arunkumar Kannan

- *Modeling, Propagating, & Evaluating Uncertainties in DL models for Medical Image Analysis* 31/01/2023
  Brigham & Women's Hospital, Harvard Medical School, Boston, USA. Invited By: Prof. Yogesh Rathi

- *Modeling & Propagating Uncertainties in ML models for MRI of patients with brain tumour* 14/04/2021
  Brain Tumour Research Seminar Series at MNI, Montreal, Canada. Invited By: Theresa Degenhard

Student Mentorship

Imperial College London Feb. 2024 – Present
co-supervised with Prof. Ben Glocker

- *Brian Cregan*, M.Eng. Thesis 2024
  - Thesis: Uncertainty Modeling with Slot Attention Network

- *Omar Todd*, Ph.D. Thesis 2024-Present
  - Thesis: Uncertainty Modeling in Medical Image Analysis

McGill University May 2017 – Apr. 2021
co-supervised with Prof. Tal Arbel

- *Saverio Vadacchino*, M.Sc. Thesis 2020-2021
  - Thesis: Hierarchical Adversarial Knowledge Distillation for Improved Inference with Missing Medical Images
  - Published at MIDL 2021 conference.

- *Barleen Kaur*, M.Sc. Thesis 2017-2019
  - Thesis: Transfer Learning for Focal Pathology Segmentation across Neuro-degenerative Diseases
  - Published at the MICCAI DART 2019 workshop.

International Institute of Information Technology - Hyderabad (IIIT-H) Jan. 2016 – July 2017
co-supervised with Prof. Jayanthi Sivaswamy

- *Aabhas Majumdar*, M.S. Thesis 2016-2017
  - Thesis: A study of Automatic Segmentation of 3-D Brain MRI and its application to Deformable Registration
  - Published at MICCAI DLF 2018 workshop.

Technical Skills

Programming Languages: Python (Regularly), MATLAB (Rarely)
Libraries: PyTorch (Regularly), Keras/Tensorflow (Rarely), OpenCV (Rarely)
Medical Imaging: FSL, Freesurfur, ANTs