Raghav Mehta

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Summary:

- ⋆ **McGill Engineering International Doctoral Award (MEITA)** (2017-2020).
- ⋆ **20 articles** published in peer reviewed journals, conferences and workshops. (Citations: **580+** and H-index: **11**)
- ⋆ **Construction of first Indian human brain Atlas**
- ⋆ **Organized 1st and 2nd MICCAI challenge** on quantifying uncertainty in the context of Brain Tumour Segmentation (BraTS)
- ⋆ **Reviewer** for **TMI**: 2019, 2020; **TUFFC**: 2020; **Front.Neuro.**: 2020; **MELBA**: 2020, 2021; **NeuroImage**: 2021; **MICCAI**: 2020-2024; **MICCAI workshop**: 2019-2024; **MIDL**: 2020-2024; and **ICLR**: 2022.
- ⋆ **Honourable Mention Review Award at MIDL 2022**: one of 23 reviewer awardees out of total 300 reviewers.
- ⋆ **Review Award Winner at MIDL 2021**: one of 9 reviewer awardees out of total 200 reviewers.
- ⋆ **Session Chair** at Medical Imaging with Deep Learning (MIDL) conference 2021.
- ⋆ **Mentored** 3 Master's theses.

Research Interests:

Image analysis (Medical Imaging, Computer Vision) & Machine Learning (Deep Learning, Bayesian Deep Learning).

Education:

Ph.D., McGill University, Canada. *(Sep'17 - July'23)*
Probabilistic Vision Group, Electrical and Computer Engineering Department,
McGill Engineering International Doctoral Award (MEITA),
Thesis: Integrating Bayesian Deep Learning Uncertainties in Medical Image Analysis
Supervisor: Prof. Tal Arbel

M.S. by Research, IIIT-Hyderabad, India (Top Computer Science Institute) *(Sep'14 - July'17)*
Centre for Visual Information Technology (CVIT), Electronics and Communication Department,
Financial Aid for Research Assistantship – DST, Govt. of India – IIIT-Hyderabad
Thesis: Population specific template construction and brain structure segmentation using deep learning methods
Supervisor: Prof. Jayanthi Sivaswamy
(Dean of IIIT-Hyderabad, among the top researchers in India for ML in Medical Imaging)

B.Eng., BVM, GTU University, India *(Aug'10 - July'14)*
Electronics Engineering Department,
Thesis: Smart Washing Machine using Fuzzy Logic Control System
Supervisors: Prof. Vithal N. Kamat and Prof. D.M. Patel

Experience:

Feb'24 - Present — **Research Associate at Imperial College London, UK.**
Working on Responsible AI (Uncertainty, Fairness, and Causality) for Medical Image Analysis.
Part of AI-POD project (Building Trustworthy tools to predict cardiovascular disease.)
Supervisors: **Prof. Ben Glocker**

July'22 - Oct'22 — **Research Scientist Intern at Meta Inc., Menlo Park, USA.**
Worked with Responsible AI (RAI) Organization @ Meta
Supervisors: **Dr. Ivan Evtimov** and **Dr. Tal Hassner**

Sep'17 - Aug'23 — **Graduate Research Assistant at Probabilistic Vision Group, McGill University, Canada.**
Worked on Bayesian deep learning with application to Brain Tumour segmentation and Multiple Sclerosis segmentation/detection.
Supervisor: **Prof. Tal Arbel**

Jan'15 - July'17 — **Graduate Research Assistant at CVIT, IIIT Hyderabad, India.**
Worked on the construction of an Electronic Indian Brain Atlas from 100 MRI volumes of Indian Population. Work included, but not limited to, data collection, pre-processing, atlas construction, and atlas validation.
Supervisor: **Prof. Jayanthi Sivaswamy**

Teaching Experience:

Sep'19 - Apr'22	**Graduate Teaching Assistant for ECSE-415, McGill University, Canada** Worked as a Teaching Assistant for four 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**
Aug'16 - Nov'16	**Graduate Teaching Assistant at ECSE-575, IIIT Hyderabad.** Worked as a Teaching Assistant for the course on Medical Image Processing. Delivered tutorials, designed assignments and projects. Lecturer: **Prof. Jayanthi Sivaswamy**

Awards:

- **Best Oral presentation award** award at FAIMI workshop MICCAI-2023.
- **Honourable Mention Review Award at MIDL 2022**: one of 23 reviewer awardees out of total 300 reviewers.
- **Best paper** award at DART workshop MICCAI-2021.
- **Review Award Winner** at MIDL 2021. One of 9 review awardees out of total 200 reviewers.
- **Best paper** award at UNSURE workshop MICCAI-2019.
- **MEITA Scholarship** – McGill Engineering International Doctoral Award, 2017-2020. (Selective).
- **GREAT Travel Award** Graduate Research Enhancement and Travel Award 2018/19 - McGill University, to attend MICCAI-2018. (Selective)
- **GMA Travel Award** Graduate Mobility 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).

Technical Skills:

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

Activities:

- *Organizer* for UNSURE workshop at MICCAI 2024, MICCAI 2023, and MICCAI 2022
- *Reviewer* for top Journals (TMI, TUFFC, MELBA, and Frontiers in NeuroScience) and Conferences (CVPR, NeurIPS, ICLR, MICCAI, MIDL, and MICCAI Workshop)
- *Organized* 1st and 2nd MICCAI challenge on quantifying uncertainty in the context of Brain Tumour Segmentation (BraTS)
- *Mentored* 3 master's theses (Aabhas Majumdar, Barleen Kaur, Saverio Vadacchino) – each theses lead to a publication
- *Student volunteer* in Neural Information Processing Systems (NeurIPS) 2018 with over 10000 participants.
- *Lab coordinator* during the 1st Machine Learning Summer School at IIIT-Hyderabad.

Contributions:

- **1st and 2nd MICCAI challenge on quantifying uncertainty in the context of Brain Tumour Segmentation (BraTS)** *(Apr'19 - Mar'21)*
  Co-organizer/co-chair, "Quantification of Uncertainty Sub-Challenge for Brain Tumour Segmentation", 1st and 2nd sub-challenge of the International MICCAI Multimodal Brain Tumour Segmentation Challenge (BraTS) 2019 and 2020, held in conjunction with the 22nd and 23rd International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2019 and 2020). Total 14 and 15 teams participated during both iterations of the challenge. The work lead to a joint publication summarizing the challenge findings. The paper was published in Machine Learning for Biomedical Imaging (MELBA) journal.
  Co-organizers: Prof. Tal Arbel (McGill University), Prof. Yarin Gal (Oxford University), Prof. Spyridon Bakas (University of Pennsylvania), Ujjwal Baid (University of Pennsylvania), and Angelos Filos (Oxford University).

- **Construction of 1st Indian Human Brain MR Atlas** *(Jul'15 - Jul'17)*
  Worked on the project for the construction of 1st Indian Human Brain atlas from T1 MRI of 100 young Indian population. We showed that on average, at the volume level, the Indian brain is smaller in comparison to Caucasian, Chinese, or Korean brains. We also found that this comparison holds true at the structure level for sub-cortical structures like Hippocampus and Putamen. This constructed template can be useful for many applications like fMRI studies, morphometric analysis etc. This project was funded by the prestigious Department of Science and Technology (DST), India. This work gained quite a bit of attention in the Indian news media [Ex. Zee News, The Hindu, India Today].

Industry Collaboration and Software License:

- McGill University, Synaptive Medical Inc., "Automatic Segmentation of Healthy Tissues and Tumours in Patient Brain Images using 3D Fully Convolutional Neural Networks", License filed and issued: Dec. 2016.

  McGill granted the sponsor, Synaptive Medical Inc, a non-exclusive, perpetual, royalty-free, non-transferable and non-sub-licensable license to IP License to use software resulting from an NSERC Collaborative Research and Development (CRD) Grant (Prof. T. Arbel (P.I.)). My role was to develop a deep learning based model for brain tumour segmentation. We developed a model based on Convolutional Neural Network for brain tumour segmentation task. This model attained 5th place at an international challenge on Brain Tumour Segmentation (BraTS) 2018. The details of the developed model are provided in the corresponding challenge proceeding publication (see Publication section). The developed model will be integrated into their software pipeline for the analysis of brain images of patients with brain tumours for the purposes of improving pre-operative planning and guidance in neurosurgical procedures.

Invited Talks

1. Raghav Mehta, *"Explainable AI and its application in Healthcare"*, 23/09/2023,
   Nirma University, Ahmedabad, Gujarat, India. Invited By: Prof. Rupal Kapdi.

2. Raghav Mehta, *"Towards Trustworthy AI for Medical Image Analysis"*, 21/09/2023,
   GE Healthcare, Bangalore, Karnataka, India. Invited By: Dr. Sudhanya Chatterjee.

3. Raghav Mehta, *"Towards trustworthy machine learning models for medical image analysis"*, 23/08/2023,
   Cornell Tech, New York, NY, USA. Invited By: Prof. Mert Sabuncu.

4. Raghav Mehta, *"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.

5. Raghav Mehta, *"Towards trustworthy models for Medical Image analysis"*, 21/07/2023,
   Imperial College London, London, UK. Invited By: Prof. Ben Glocker.

6. Raghav Mehta, *"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.

7. Raghav Mehta, *"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.

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

9. Raghav Mehta, *"Modelling, Propagating, and Evaluating Uncertainties in Deep Learning models for Medical Image Analysis"*, 31/01/2023,
   Brigham & Women's Hospital, Harvard Medical School, Boston, MA, USA. Invited By: Prof. Yogesh Rathi.

10. Raghav Mehta, *"Modeling and Propagating Uncertainties in Machine Learning for medical images of patient with brain tumour"*, 14/04/2021,
    Brain Tumour Research Seminar Series (BTRSS) at Montreal Neurological Institute, McGill University, Montreal, Canada. Invited By: Theresa Degenhard.

Publications:

- Published in the top Journals and Conferences.
- Total articles published: **20** in 8 years of research in Machine Learning and Medical Image Analysis.
- Total Citation: **580**+ with H-Index: 11

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. (**Short-listed 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 (Acceptance Rate: **20%**)

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.

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