

# Puneet Kumar, Ph.D.

Postdoctoral Data Scientist · MD Anderson Cancer Center, Houston, TX

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## Research Profile

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Computational imaging scientist with expertise in multimodal MRI biomarker development, deep learning-based disease modeling, and translational neuroscience. Experienced in designing and implementing scalable imaging pipelines that integrate structural MRI, functional MRI, and perfusion imaging (DSC, DCE) across clinical and preclinical datasets to support precision medicine.

Demonstrated ability to collaborate across disciplines with clinicians, radiologists, and biologists, contributing to the development of clinically relevant imaging biomarkers. Actively applying AI-driven neuroimaging methods for disease staging, longitudinal progression modeling, and biomarker discovery in neurodegenerative and oncology settings.

Seeking to leverage expertise in multimodal neuroimaging, integrative biomarker modeling (MRI, PET), and scalable pipeline development to advance Neuroscience Precision Measures and support clinical development programs.

## Technical Skills & Applied Expertise

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**Multimodal Neuroimaging:** Structural MRI, functional MRI, perfusion MRI (DSC, DCE); multimodal biomarker extraction, harmonization, and quantitative analysis

**Biomarker Modeling:** Integration of MRI, PET, and fluid biomarkers; multivariate predictive modeling; disease staging; longitudinal progression modeling; validation across independent datasets

**Machine Learning & Deep Learning:** CNNs, U-Net, transformer-based architectures; regularized regression, latent variable models, ensemble methods; self-supervised learning; explainable AI

**Scalable Data Pipelines:** End-to-end pipeline development for data ingestion, QC, processing, and feature engineering; Snakemake, NiPytype, Nextflow; SLURM-based HPC; containerized, reproducible workflows (Docker)

**Clinical Translation:** Cross-functional collaboration with clinicians and scientists; model interpretability for clinical decision support; biomarker study design; translational research and evidence generation

**Computational Tools & Programming:** ANTs, FSL, AFNI, FreeSurfer, SPM12, 3D Slicer, MRICroGL; Python, R, MATLAB, SQL, Bash; version control (Git)

## Research Experience

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### Postdoctoral Data Scientist

2023 – Present

*Department of Cancer Systems Imaging* | MD Anderson Cancer Center, Houston, TX

- Lead development of **multimodal MRI imaging biomarker pipelines** for tumor characterization, spatial heterogeneity analysis, and quantitative phenotype extraction — directly translatable to neurodegenerative disease staging and progression modeling.
- Developed and validated **deep learning models** (segmentation, voxel-wise prediction) on multimodal MRI datasets; emphasis on model robustness, reproducibility, and clinical interpretability.
- Built **scalable end-to-end computational pipelines** for data onboarding, quality control, feature engineering, and biomarker generation across large, heterogeneous imaging datasets.
- Integrated **multimodal imaging, clinical, and quantitative datasets** to support biomarker discovery and patient stratification in translational research settings.
- Collaborated cross-functionally with clinicians, pathologists, and computational biologists in a research and medical environment to translate AI-generated biomarkers into clinically meaningful insights.
- Contributed to **study design and analytical strategy** for imaging-based biomarker discovery workflows aligned with translational and clinical decision-support requirements.

### Data Science Fellow

2024 – 2025

*Institute for Data Science in Oncology* | MD Anderson Cancer Center, Houston, TX

- Specialized in **quantitative analysis and biomarker discovery** from multimodal imaging and pathology datasets.
- Developed **statistical and machine learning models** for survival analysis, including **progression-free survival (PFS)** and overall survival prediction, integrating imaging, clinical, and pathology data.

- Built reproducible analytical workflows for **multimodal data integration** and predictive modeling in translational oncology research.
- Collaborated across disciplines to integrate **imaging, pathology, and clinical data**, enabling data-driven precision medicine insights.

### Senior Research Fellow

2023

*Centre for Biomedical Engineering* | Indian Institute of Technology (IIT) Delhi, India

- Developed **deep learning–based medical image analysis frameworks for brain tumor MRI**, enabling automated tumor and tissue segmentation on clinical neuroimaging datasets.
- Designed and implemented **AI-driven segmentation models for quantitative characterization of brain tumor regions** — directly relevant to neurodegenerative disease imaging biomarker workflows.
- Evaluated model performance on clinical neuroimaging data with focus on **robustness, generalizability, and translational relevance**.

### Research Fellow (Ph.D.)

2018 – 2023

*School of Computer & Systems Sciences* | Jawaharlal Nehru University, New Delhi, India

- Developed **machine learning and clustering-based methods for neuroimaging analysis** — automated pattern discovery and quantitative characterization of human brain MRI data.
- Designed and evaluated **computational models for brain MRI segmentation and disease pattern analysis**, contributing to early-stage neuroimaging biomarker discovery.
- Conducted large-scale experimental validation benchmarking state-of-the-art approaches with emphasis on **reproducibility and generalization across neuroimaging datasets**.
- Disseminated findings through **peer-reviewed publications** in medical image computing.

## Education

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### Ph.D., Computer Science & Technology

2018 – 2023

Jawaharlal Nehru University, New Delhi, India

*Focus: Machine learning, medical image analysis, brain MRI segmentation, quantitative neuroimaging*

### M.Sc., Computer Science

2016 – 2018

South Asian University, New Delhi, India

*Focus: Machine learning, optimization, predictive analytics, and statistical modeling*

### B.Sc. (Hons.), Computer Science

2012 – 2015

University of Delhi, New Delhi, India

*Foundation in programming, algorithms, probability, and applied computational methods*

## Selected Publications & Presentations

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### Journal Articles

1. Kandpal, A., **Kumar, P.**, Gupta, R.K., & Singh, A. (2025). **Automatic Multiclass Tissue Segmentation Using Deep Learning in Brain MR Images of Tumor Patients.** *Journal of Computer Assisted Tomography*.
2. **Kumar, P.**, Agrawal, R.K., & Kumar, D. (2023). **Fast and robust spatial fuzzy bounded k-plane clustering for human brain MRI image segmentation.** *Applied Soft Computing*, 133, 109939.
3. **Kumar, P.**, Kumar, D., & Agrawal, R.K. (2022). **Fuzzy k-plane clustering with local spatial information for segmentation of human brain MRI.** *Neural Computing and Applications*, 34(6), 4855–4874.
4. Kumar, D., Agrawal, R. K., & **Kumar, P.** (2020). **Bias-corrected intuitionistic fuzzy c-means with spatial neighborhood information for human brain MRI segmentation.** *IEEE Transactions on Fuzzy Systems*, 30(3), 687–700.

### Selected Abstracts & Conference Presentations

1. **Kumar, P.**, Semmineh, N., Guha, I., & Quarles, C.C. (2026). **Patch2Voxel: Denoising Perfusion MRI with Self-Supervised Learning.** *ISMRM & ISMRT Annual Meeting & Exhibition*, Cape Town, South Africa — **Oral Presentation.**

2. Fu, Z., Kumar, P., Servati, M., Mokashi, C., Semmineh, N., Majd, N.K., Puduvalli, V.K., & Quarles, C.C. (2026). **Zero-Shot Physics-Informed Neural Networks for Robust Multi-Vendor DSC-MRI Perfusion Quantification in Glioblastoma Patients.** *ISMRM & ISMRT Annual Meeting & Exhibition*, Cape Town, South Africa — **Power Pitch Presentation.**
3. Kumar, P., Semmineh, N., & Quarles, C.C. (2025). **Multi-Echo Dynamic MR Data Denoising with Deep Learning.** *ISMRM Workshop on Perfusion MRI: Found in Translation*, Pamplona, Spain — **Poster & Power Pitch Presentation.**
4. Kumar, P., Guha, I., Anil, A., Healey, D., Damodar, N., Wilks, A.S., De La Cerda, J., Atiyah, A., Ackerstaff, E., Yankeelov, T., & Quarles, C.C. (2025). **Bridging Scales in Preclinical Brain Imaging: From Ex Vivo Light Sheet Fluorescence Microscopy to In Vivo MRI and PET.** *Inaugural Cancer Neuroscience Program Scientific Retreat*, Houston, TX, USA — **Poster Presentation.**
5. Guha, I., Ravi, H., Bajaj, S., Pan, Y., Kumar, P., Ackerstaff, E., Healey, D., Damodar, N., Wilks, A.S., De La Cerda, J., Atiyah, A., & Quarles, C.C. (2025). **Leveraging MRI-Based Detection of High-Grade Glioma Neuronal Functional Connectivity to Map Early Tumor Invasion Using Deep Learning.** *Inaugural Cancer Neuroscience Program Scientific Retreat*, Houston, TX, USA — **Poster Presentation.**
6. Anil, A., Guha, I., Hormuth, D.A., Das, A., Healey, D., Kumar, P., Lima, E.A.B.F., Quarles, C.C., & Yankeelov, T.E. (2025). **Integrating MRI and Light-Sheet Fluorescence Microscopy to Validate and Improve Imaging-Based Tumor Modeling.** *Annual TACC Symposium*, Austin, TX, USA — **Poster Presentation.**
7. Kumar, P., Anil, A., Mathew, E., & Quarles, C.C. (2024). **Enhancing Multi-Echo Dynamic MR Data with a Neural Network Approach.** *Division of Diagnostic Imaging Trainee Research Symposium*, Houston, TX, USA — **Poster Presentation.**
8. Kumar, P., Anil, A., Mathew, E., & Quarles, C.C. (2024). **A Neural Network-Based Approach for More Robust Multi-Echo Dynamic MR Imaging.** *MD Anderson Cancer Center Trainee Research Day*, Houston, TX, USA — **Poster Presentation.**

## Awards & Honors

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- **Trainee Stipend Award** (Oral Presentation), ISMRM & ISMRT Annual Meeting & Exhibition, Cape Town, South Africa (2026)
- **Travel Grant**, ISMRM Workshop on Perfusion MRI: Found in Translation, Pamplona, Spain (2025)
- **IDSO Fellowship**, Institute for Data Science in Oncology, MD Anderson Cancer Center (2024–2025)
- **Travel Scholarship**, Division of Diagnostic Imaging Trainee Research Symposium, MD Anderson Cancer Center (2024)
- **People’s Choice Poster Award**, MD Anderson Cancer Center Trainee Research Day (2024)
- **Senior Research Fellowship (UGC National Fellowship)**, University Grants Commission, India (2020–2023)
- **Junior Research Fellowship (UGC National Fellowship)**, University Grants Commission, India (2018–2020)
- **President Scholarship (University Fellowship)**, South Asian University, India (2017–2018)

## Invited Talks

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- Invited Speaker, *CATALYST Summer Program Orientation*, MD Anderson Cancer Center, Houston, TX (2024) — Topic: Machine learning and computational approaches in cancer imaging and translational biomedical research.

## Relevant Training & Workshops

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- ISMRM Workshop on Perfusion MRI: Found in Translation, March 15–17, 2025, Baluarte Conference Centre, Pamplona, Spain — quantitative imaging, perfusion modeling, and translational MRI analytics.
- 18th Annual Meeting of the American Society of Functional Neuroradiology (beyondBOLD), Pre-Conference Workshops, September 18–21, 2025, Austin Marriott Downtown, Austin, TX, USA.
- ML for Biomedical Signal Classification Workshop, MathWorks / MD Anderson Cancer Center, 2025.
- UCL Medical Image Computing Summer School (MedICSS), University College London, UK (2022) — advanced medical image analysis, deep learning, and computational imaging.
- Cambridge Centre for AI in Medicine (CCAIM) Summer School, University of Cambridge, UK (2022) — AI applications in clinical and healthcare data.

## References

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- **C. Chad Quarles, Ph.D.**  
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