

SAYONI CHAKRABORTY

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EDUCATION

PhD, Mathematics — Topological Machine Learning for Medical Imaging & Biomedical Data Science

GPA 3.72 | *Expected May 2027*

The University of Texas at Dallas

M.S., Mathematics, Data Science Specialization, UT Dallas · Graduate Certificate in Data Science

Dec 2025

M.S. (2021) & B.S. (2019), Mathematics, Jadavpur University, Kolkata, India

GPA – 4.0 | 2016 – 2021

TECHNICAL SKILLS

Programming: Python, R, SQL | **Libraries:** Pandas, NumPy | **Machine Learning & Deep Learning:** PyTorch, TensorFlow/Keras, scikit-learn, Classical ML (logistic regression, SVM, random forests, gradient boosting), XGBoost, feature engineering, CNNs, Vision Transformers, multimodal learning, contrastive learning, ensemble methods | **Statistics & Model Evaluation:** Statistical inference, hypothesis testing, regression, cross-validation, ROC/PR-AUC analysis, bootstrap/resampling methods, class-imbalance evaluation, model interpretability | **Topological Data Analysis:** Persistent homology, cubical, point-cloud & graph filtrations, Betti curves, vectorization techniques, multiparameter persistence, giotto-tda | **Biomedical Data & Imaging:** CT, MRI, X-ray, dermoscopy, histopathology, DICOM/NIfTI, medical image preprocessing, segmentation and classification, spatial transcriptomics & proteomics, registry data, patient-level clinical data

RESEARCH & PROFESSIONAL EXPERIENCE

Research Intern — MD Anderson Cancer Center, Houston, TX

June 2026–Present

- Built a topology-driven framework for spatial transcriptomics and proteomics data to characterize changes in tumor microenvironment organization across stages of lung adenocarcinoma progression.
- Designed biologically informed filtrations and persistent-homology representations to quantify spatial tissue architecture, cellular heterogeneity, and cell-type organization across ~1,600 spatial ROIs.

Doctoral Researcher — Coskunuzer Lab, UT Dallas

Fall 2022 – Present

Multimodal Clinical AI for Liver Transplantation — *collaboration with University of Arizona College of Medicine*

- Led the machine learning pipeline for a national biopsy-verified study of donor liver steatosis, integrating multi-site CT imaging with OPTN/UNOS clinical data from 2,709 deceased donors in a highly imbalanced setting (11.2% high-steatosis prevalence).
- Developed and evaluated multimodal models combining CT biomarkers, topological imaging features, body-composition measures, and donor clinical variables, achieving ROC-AUC 0.82 and PR-AUC 0.48 with consistent performance on temporal hold-out validation.
- Benchmarked clinical, conventional CT, topological, and deep-learning approaches to quantify the added value of increasingly complex models for biopsy-defined steatosis assessment.

Topological Deep Learning for Medical Imaging

- Developed topology-infused deep-learning frameworks across 3D MRI, CT, and X-ray imaging, integrating persistent homology and Betti representations with CNN/Transformer architectures; introduced sliding-band filtrations and topology-aware contrastive learning, improving ROC-AUC by up to 12 points over strong deep-learning baselines.
- Applied multiparameter persistence and topological feature fusion to dermoscopy and histopathology, combining multiscale structural signatures with Vision Transformers and using statistical analysis, ablation studies, and interpretable topological biomarkers to evaluate robustness, feature engineering, and cross-dataset generalization.

SIAM Industrial Mathematics Workshops — MPI & GSMCM (2024–25): Chronic kidney disease progression modeling with Vironix Health; direction-of-arrival estimation with Raytheon Technologies.

Graduate Teaching Assistant — UT Dallas (2022–Present): Teach and grade undergraduate and graduate mathematics courses.

PUBLICATIONS

Chakraborty, S. et al. A national biopsy-anchored benchmark reveals a CT performance ceiling for donor liver macro steatosis assessment. (Review)

Tastan, F.*, **Chakraborty, S.***, Lee, S., Coskunuzer, B. [MultiPersistence Topological Fusion with Vision Transformers for Skin Cancer Detection](#).

MIDL 2026, PMLR 315:2071–2096. (*equal contribution)

Chakraborty, S. et al. [Topoformer: Topology-Infused Transformers for Medical Imaging](#). *Machine Learning for Health 2025 PMLR 297:23–40.*

Chakraborty, S. et al. [Topology-Aware Deep Models for Skin Lesion Classification](#). *ISIC at MICCAI 2025; Honorable Mention Award.*

Fatema, S., Nuwagira, B., **Chakraborty, S.**, et al. [TopOC: Topological Deep Learning for Ovarian and Breast Cancer Diagnosis](#). Springer LNCS

AWARDS & SERVICE

Mei-Lein Fellowship, UT Dallas (2026) | **Second Place Poster Award**, ASA North Texas (2026) | **Travel awards:** SIAM, CHIL, ML4H, LBNL DL4Sci |

Selected Participants: ICERM Foundations of Computational Geometry & Topology (2026) · SLMath AxiOM: Machine Learning for Mathematics

(2027) · DL4Sci Summer School, Lawrence Berkeley National Laboratory (2025) | **Invited Speaker:** AMS Special Session on Applied Topology & TDA

(2025), STDC Applied Topology & Data Session (2026), SIAM Conference on Imaging Science (IS26) Minisymposium, AMS Special Session at George

Washington University (2026) | **Organizer:** AMS/SIAM Special Sessions & Minisymposia (2024–26) | **President**, SIAM Student Chapter (2023–25)