

Torsha Majumder

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Education

Master of Science in Physics (Thesis)

Jan. 2024 – Present

The University of Lethbridge, Lethbridge, Alberta, Canada
Advisor: Prof. Locke Spencer

Master of Science in Computer Science

Aug. 2018 – May 2020

The University of Texas at Dallas, Richardson, Texas, USA
Thesis: "*Ensembles of oblique decision trees*"
Advisor(s): Prof. Sriraam Natarajan and Dr. Gautam Kunapuli

Bachelor of Technology in Information Technology

Jul. 2013 – Jul. 2017

Maulana Abul Kalam Azad University of Technology, Kolkata, West Bengal, India
Final Year Project: "*Institutes Library Management System*"
Advisor: Prof. Arindam Chakravorty

Publications

- Majumder, T., Pruzhinskaya, M.V., Ishida, E. E. O., Malanchev, K. L., Semenikhin, T. A., *Superluminous supernova search with PineForest*. arXiv preprint, <https://arxiv.org/abs/2410.21077>
- Majumder, T., Pruzhinskaya, M. V., Ishida, E. E. O., Malanchev, K. L., *Detection of Anomalous and Rare Transients using Contrastive Learning*, in prep, 2024.
- Majumder, T. (2020). *Ensembles of oblique decision trees* [Master's Thesis, University of Texas, Dallas]. UTD Theses and Dissertations. URI: <https://hdl.handle.net/10735.1/8818>
- Schussler, J., Penev, K., Majumder, T., Comprehensive Bayesian Modeling of Tidal Circularization of Kepler Eclipsing Binaries, in prep, 2024.
- Huang, H., Muthukrishna, D., Nair, P., Zhang, Z., Fausnaugh, M., Majumder, T., Ricker, G. Foley, R., Predicting the Age of Astronomical Transients from Real-Time Multivariate Time Series. 2023, Neural Information Processing Systems (NeurIPS 2023), arXiv:2311.17143.

Research Experiences

The University of Lethbridge, Lethbridge, AB, Canada

Jan. 2024 – Present

Master's Thesis: *Characterization and Optimization of the Transition-Edge-Sensor (TES) Detector Systems in a Double Fourier Interferometer (developed at U Lethbridge)*

Advisor: Prof. Locke Spencer

- Validating the temperature calibration of the TES detectors by testing various current bias levels within the range of 1 μ A to 15 μ A.
- Investigating the effect of the bit-depth, which can influence measurement accuracy by transitioning from 32-bit integer Proportional-Integral-Derivative (PID) configuration to 32-bit float PID algorithms.
- Deriving and validating the optimal noise parameters for the off-axis pixels, similar to those used for the central detector.
- Analyzing the thermal and electrical cross-talk experimental data to identify the behavior of the central detector and its off-axis pixels, focusing on the state of inactivity and near its maximum heating output.
- Comparing the efficacy of rapid scan versus step-integrate approaches in both the (Fourier Transform Spectrometer) FTS and (Double-Fourier-Interferometer) DFI modes.

The SNAD Team Collaboration

Apr. 2024 – Present

- **Project: *Superluminous Supernovae (SLSN) Search in the Zwicky Transient Facility (ZTF) using PineForest***

In collaboration with the [SNAD](#) team, I analyzed the ZTF DR8 data release to identify potential Super luminous Supernovae (SLSN) candidates using the [Pineforest algorithm](#) developed by the SNAD team. Leveraging prior knowledge in the form of known SLSN objects from [Transient Name Server](#) (TNS), my analysis resulted in the discovery of 10 SLSNe candidates, out of which 8 are potential SLSNe, including two new candidates ([AT 2018moa](#) and [AT 2018mob](#)), which have been reported at TNS by the SNAD team. The other 6 potential SLSNs are - SN 2018fcg, SN 2018dfa, SN 2019bmj, AT 2019nkc, AT 2019sez, and AT 2019tjf.

- **Project: *Detection of Anomalous and Rare Transients using Contrastive Learning***

This collaborative project with the [SNAD](#) team involves designing a BERT-based transformer model with a contrastive loss function to acquire embeddings through unsupervised learning. These embeddings will be integrated into active learning algorithms, such as [AAD](#) and [Pineforest](#), developed by the SNAD team, to identify anomalous light curves within the ZTF and LSST data. This research is currently undergoing preparation for publication, and a thorough analysis of the findings will be released shortly. The code will be made publicly accessible upon acceptance of the paper.

The University of Texas at Dallas, Richardson, Texas, USA

Nov. 2021 – Present

Project: *Deep Probabilistic Neural Network for Inverse Tidal Evolution*

Advisor: Prof. Kaloyan Penev

- I developed a probabilistic deep neural network to provide reasonable estimates for the initial values of a numerical solver required at each MCMC step of the inverse tidal evolution to find the initial orbital period and eccentricity to match the present-day values in the Kepler catalog. As a result, fewer evolutions are required to find the correct initial values, owing to faster solver convergence. The initial findings from the 1D solver indicate that the Probabilistic neural network succeeded the existing brute-force algorithm in ~65% of instances, compared to the latter's success rate of ~10%. It is a paper in preparation, and I have presented my work at [The International Meeting on Eclipsing Binary Star Systems, 2024](#).

Massachusetts Institute of Technology, Cambridge, MA, USA

Oct. 2021 – Nov. 2023

Project: *Self-supervised classification and anomaly detection of transients*

Advisor: Dr. Daniel Muthukrishna

- Prepared a machine-learning pipeline for TESS, PLATiCC, and PanSTARRS transient light curves to perform data pre-processing, feature extraction, self-supervised classification, and anomaly detection processes
- Created a data pipeline to identify transiting exoplanet signals and remove noise from the Kepler and TESS light curves
- Worked on Deep Learning for the Automated Spectral Classification of Supernovae and Their Hosts (DASH), where I changed the architecture from TensorFlow to Keras and applied batch processing and evaluated its performance on new transient types – Kilonova, AGNs, and TDEs

Work Experiences

Graduate Research Assistant, The University of Lethbridge, AB, Canada

Jan. 2024 – Present

- Conducting detector calibration experiments by setting up cryogenic detectors and related laboratory equipment to conduct scientific experiments to explore detector parameter optimization for the full detector array

- Processing raw data recorded from instrumentation into higher-level data products ready for interpretation, developing routines for averaging results, determining statistical uncertainties and noise limitations, and refining routines to convert recorded data into spectra and visibility curves

Senior Data Scientist, NU Energy India, Kolkata, West Bengal, India **Aug. 2023 – Dec. 2023**

- Analyzed and designed online dashboards as error analysis tools for electrical power generation systems
- Led and mentored the data analytics team

Data Scientist, Verizon, Sunnyvale, California, USA **Jun. 2021 – May 2023**

- Designed a prototype for the vendor recommendation system in the FUZE Regulatory module that suggested the top vendors based on the user's specifications and developed a forecasting model for their performance prediction
- Led a team of three software engineers and worked cross-functionally to coach the data analytics team

Software Engineer, Centillion Infotech LLC, Dallas, Texas, USA **Jul. 2020 – Feb. 2021**

- Designed and developed APIs and RESTful Services for the enterprise product in the business
- Built extensive test coverage for all new features, which reduced customer complaints by 7%

Data Analyst, NU Energy India, Kolkata, West Bengal, India **Jul. 2017 – Jul. 2018**

- Cleaned & analyzed data (electrical parameters) obtained from energy audits of the Bureau of Energy Efficiency (India) and water audits from the Indian Railways and identified the losses in the energy generation and distribution systems, which resulted in a total savings of \$10M/year

Teaching Experience

Graduate Teaching Assistant, The University of Lethbridge, AB, Canada **Jan. 2024 – Present**

- **Fall Term:** Instructor for the courses - Introduction to Biophysics (PHYS 1050 L04 and PHYS 1050 L06)
- **Spring Term:** Instructor for the courses - Introduction to Biophysics (PHYS 1050 L04 and PHYS 1050 L06), Engineering Mechanics (ENGG 2060A)

Faculty Member, 2U Inc./ edX, Sunnyvale, California, USA **Dec. 2020 – May 2023**

- Worked as the data analytics instructor and tutored over 100+ students across universities in the USA and Australia
- Helped in preparing the lessons and bug fixes for the online curriculum of the data analytics and fintech bootcamp programs

Awards and Honors

- University of Lethbridge Graduate Research Award (ULGRA), 2024
- Awarded as the Associate Member of the Institute of Engineers (India) in Computer Science and Engineering in 2017
- Awarded for the best 2017 final-year project - *Institutes Library Management System* - by the institution ([STCET](#)) and was among the top finalist for the software development competition by Cognizant (India)

Talks/Presentations

- **Deep Probabilistic Neural Network for Inverse Tidal Evolution** **Sep. 2024**
--- The International Meeting on Eclipsing Binary Star Systems, Weihai, Shandong, China
- **Unsupervised classification and anomaly detection of TESS transients** **Sep. 2022**
--- *TESS Science Talk*, Massachusetts Institute of Technology, Cambridge, MA, USA

Skills

Programming Languages: Python, MATLAB, R, SQL, JAVA, C, LabVIEW, Bash

Software/ Packages: Scikit-Learn, SciPy, TensorFlow, PyTorch, Keras, Pandas, Astropy, Lightkurve, Matplotlib, PySpark

Certifications: [Astronomy: Exploring Time and Space](#), [Computer Vision](#), [Linear Algebra](#), [AWS: Cloud Security](#), [Tableau](#), [Google Cloud Big Data and Machine Learning](#), [Amazon SageMaker](#)

Professional Memberships

- Institute of Engineers (India)
- Artificial Intelligence Society, The University of Texas, Dallas
- Society of Women Engineers, The University of Texas, Dallas

Outreach

- Please find the link to my guest post on [Astrobite](#): [Anomaly Detection and Classification of Astronomical Objects in the Age of Machine Learning](#) !
- On July 15, 2024, I participated in a workshop hosted by [SHAD Canada](#), where I contributed by guiding students in applying signal processing techniques, including the development of filters and amplifiers.
- On May 13, 2024, I delivered presentations on FAR-IR instrumentation. I conducted laboratory tours for students from **Lethbridge Collegiate Institute (LCI)**, intending to engage them in physics and astronomy.
- On February 27, 2024, I coordinated an educational visit to the [Lethbridge Astronomical Society \(LAS\)](#) for undergraduate students interested in astronomy.
- I have been a **Citizen Scientist** at [Zooniverse](#) since May 2020.
- I was a computer science outreach instructor for elementary schools in Richardson and Mesquite, Texas, USA.