Anirban Bairagi

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anirban-bairagi anirbanbairagi

Education

Institut d'Astrophysique de Paris, CNRS & Sorbonne Université — *Jan 2023 – Present*
PhD is Astrophysics, Statistics and Machine Learning — ***Simons Foundation***
- **Advisor: Dr. Benjamin Wandelt**

Indian Institute of Technology Kharagpur — *July 2017 – April 2022*
B.S-M.S in Physics — ***CGPA: 8.55/10***
- **Coursework:** General Relativity, Astrophysics, Mathematics, Statistics, Deep Learning

Experience

Technical Consultant — *Calcutta, India*
TCG Digital — *June 2022 – Dec 2022*
- Automated end-to-end monthly analytics pipeline in Python, from SQL data extraction to final analysis, reducing manual workload and turnaround time for client reporting.
- Performed data-driven workforce analytics on leave patterns in a major U.S. supermarket chain, enabling optimized staffing strategies that reduced revenue loss due to understaffing and overtime costs by 85%.
- Reduced the loss incurred by the pharmaceutical companies by 72% due to insufficient and excessive supply of diagnostic kits in different countries of Europe using LDA and XGBoost.

Caltech SURF - LIGO — *Pasadena, CA*
California Institute of Technology — *May 2021 – July 2021*
- Simulated laser beam spot images incorporating mirror micro-roughness and CCD sensor noise to mimic real-world optical imperfections in the LIGO detector.
- Developed a Convolutional Neural Network (CNN) to infer beam position from noisy CCD images with sub-pixel accuracy ($\leq 40\ \mu m$) to mitigate noise from the detector signal due to misalignment of mirrors.

MITACS Globalink Research Fellow — *London, Ontario*
Western University — *July 2021 – Oct 2021*
- Modeled Continuous Gravitational Wave (CGW) signals from non-precessing triaxial neutron stars.
- Built a real-time CGW detection algorithm using Convolutional Neural Network (CNN), enabling prompt identification of potential electromagnetic counterparts.
- Performed Bayesian inference on the signals using Markov Chain Monte Carlo (MCMC) to obtain robust posterior distributions for astrophysical parameters.

Publications

Gravitational Waves Detection and Glitch Classification using CNN — *2020*
Anirban Bairagi — *Royal Astronomical Society*

LIGO Laser Beam Tracking — *2021*
Anirban Bairagi, Yehonathan Drori, Tega Edo, Rana Adhikari

How many simulations do we need for simulation-based inference? — *2025*
Anirban Bairagi, Benjamin Wandelt, Francisco Villaescusa-Navarro — *Submitted to A&A*

PatchNet: GPU is not limitation anymore for Cosmological inference
Anirban Bairagi, Benjamin Wandelt — *draft in prep.*

Technical Skills

Languages: Python, Cython, Mathematica, MATLAB, C, SQL, HTML, CSS, Arduino
Machine Learning: XGBoost, Deep Learning, CNN, YOLO, Diffusion models, Normalizing flows, Transformers
Frameworks/Libraries: Numpy, Pandas, Scipy, Scikit-learn, Matplotlib, Pytorch, TensorFlow, Keras, OpenCV
Tools: Weights & Biases, Git, Linux, CMake