Sumantrak Mukherjee

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Education

- **Birla Institute of Technology and Science** — Pilani, India
  Bachelor of Engineering Hons - Electronics and Instrumentation — *June 2019 - May 2023*
  Courses: *Neural Networks and Fuzzy Logic, Deep Learning, Probability and Statistics, Linear Algebra, Calculus, Discrete Mathematics, Operating Systems, Object Oriented Programming, Controls Systems, Industrial Instrumentation and Control, Programming in C*
  MOOCs: *Causality Bootcamp (Simons Institute), Causal ML Workshop (Altdeep), DeepBayes RU 2019, CS 285 (UC Berkley), CS 231n (Stanford), Deep Learning Specialisation (DeepLearning.ai)*

Skills Summary

- **Programming**: ***Advanced :*** Julia, Python, JavaScript | ***Intermediate :*** Java, C,C++, MATLAB
- **Framework**: ***Advanced :*** Pytorch, Flux.jl, Numpy, MLJ, Scikit-learn | ***Intermediate :*** Pyro, JAX
- **Tools**: ***Advanced :*** Git, Terminal, LaTeX| ***Intermediate:*** Simulink, Docker, Slurm

Experience

- **Junior Researcher - DSA DFKI GmbH** — Kaiserslautern, Germany
  Advised by Prof. Dr. Sebastian Vollmer — *Oct 2023 - Present*
  - My current research focuses on developing explainable and robust machine learning techniques for sequential decision-making and event modelling.
  - I presently supervise 3 bachelor thesis students and help recruit Researchers.
  - Contributed to 3 work packages of grant proposal **AI4Nof1**
- **Bachelors Thesis - DSA DFKI GmbH** — Kaiserslautern, Germany
  Supervised by Prof. Dr. Sebastian Vollmer and Dr. Mengyan Zhang — *Jan 2023 - April 2023*
  - Worked on **Scalable Causal Bandits with Adequate Causal Discovery**
  - Designed an algorithm to maximise reward variable of linear SCMs with **unknown graphs**
  - Scaled the algorithm to bigger graphs using **Differential Bayesian Structure Learning**
  - Implemented and demonstrate **empirical convergence** of algorithm in random graphs generated using Erdős Rényi algorithm
- **Research Collaboration - Columbia University** — Remote
  Supervised by Dr. Zenna Tavares(Columbia University), Dr. Robert Ness(MSR) — *Jan 2022 - Aug 2022*
  - Implementing models of **rational agents** for (PO)MDPs
  - Create richer models of human planning, which capture **human biases** and **bounded rationality**
  - Created **JuliaProgrammingPuzzles.jl** to **benchmark** ParametricInversion.jl
- **Research Collaboration - Vollmer Research Group** — Remote
  Supervised by Dr. Sebastian Vollmer (DFKI), Dr. Moritz Schauer (Chalmers) — *Dec 2021 - May 2022*
  - Researched various **Algorithmic Fairness Techniques** and **Survival Metrics**
  - Compiled and Summarised Literature on the **Notion of Fairness** in **Actuary**
  - Contributed to the **visualisation** of data and in the **ideation** of forming notions of Fairness in survival metrics
- **Julia Summer of Code** — Remote
  Supervised by Dr. Sebastian Vollmer, Dr. Jiahao Chen, Dr. Moritz Schauer — *May 2021 - July 2021*
  - Implemented **Fairness Inprocessing Algorithms** using techniques such as **Constrained Optimisation** and **Adversarial Debiasing**
  - **Integrated** with the **MLJ Interface** to easily make algorithms written in MLJ to be made fair
  - Experimented with various techniques to **stabilise adversarial training** and improve pairwise fairness
- **Learning Mate** — Remote
  AI/ML Intern — *May 2021 - July 2021*
  - **Researched** K-12 education scenarios in the US
  - Implemented **algorithm** to predict students at **risk** using **ensemble methods**
  - Created **data-set** and **extracted features** used to predict suitable interventions
  - Collaborated with Psychiatrists to **cluster students at risk** and develop **suitable interventions** for them
- **Employee Outlook** — Remote
  Data Science Intern — *Dec 2020 - April 2021*
  - Implemented **language model** from scratch to extract **keywords** from user reviews using SPaCy and BERT
  - Developed prototype to **suggest** and **rank** users based on qualities specified for a position
  - Created **APIs** and **dockerized** these applications and hosted them on an **AWS EC2 instance**

Publications and Workshops

- **Peculiarities of Counterfactual Point Process Generation - STCausal Workshop at ACM SIGSPATIAL 2024**: Gerrit Großmann,**Sumantrak Mukherjee**, Sebastian Vollmer
- **Graph Agnostic Causal Bayesian Optimisation - NeurIPS BDU Workshop 2024**: **Sumantrak Mukherjee**, Mengyan Zhang, Seth Flaxman, Sebastian Vollmer
- **Had enough of experts? Elicitation and evaluation of Bayesian priors from large language models - NeurIPS BDU Workshop 2024**: David Selby, Kai Spriestersbach, Yuichiro Iwashita, Dennis Bappert, Archana Warrier,**Sumantrak Mukherjee**, Muhammad Nabeel Asim, Koichi Kise, Sebastian Vollmer
- **X Hacking: The Threat of Misguided AutoML - Under Review at AISTATS**: Rahul Sharma, **Sumantrak Mukherjee**, Sergey Redyuk, Andrea Sipka, Sebastian Vollmer, David Selby
- **Flexible Group Fairness Metrics for Survival Analysis - DSHealth 2022**: Raphael Sonabend, Florian Pfisterer, Alan Mishler, Moritz Schauer, Lukas Burk, **Sumantrak Mukherjee**, Sebastian Vollmer

Honors and Awards

- **Selected** among a large pool of **applicants** for **JSoC 2021**.
- Received a **grant** of **50,000 Indian Rupees** for the project **Reinforcement Learning based Traffic Control System**.
- Ranked **first** in the **Hult Prize Competition** among selected teams from **top tier colleges across India and Bangladesh**. Worked on an innovative solution to cater to millions of farmers across India under the challenge banner "Food For Good".

Academic Projects

- **Reinforcement Learning based Traffic Control System** — BITS Pilani
  Supervised by Dr. Amit Dua — *Jan 2022 - May 2022*
  - Created **Synthetic Dataset** for Cityflow using GoogleMaps API and Statistics provided on the Indian Government Website
  - **Finetune**d models implemented in **CoLight** and **Towards a thousand lights** on our dataset
  - Assisted in development of **hardware prototype** using Raspberry PI
- **Spark Plug Analysis Using Computer Vision** — Team AIRMAN, IIT Kharagpur
  Supervised by Dr. Surya K. Pal — *Dec 2020 - April 2021*
  - Implemented a Computer Vision Model to **identify defects** in Spark Plugs in **low resolution**.
  - Created a **synthetic dataset** using **AutoCAD** to capture images at different angles.
  - Implemented another model to **count** the **total number** of Spark Plugs placed in a tray.
- **Hate Speech Detection on the BITS Confession Facebook Page** — ACM, BITS Pilani
  Independent Project — *Feb 2020 - June 2020*
  - **Scraped** the facebook page of BITS Confessions to form a **dataset** and acquired censored confessions from the BITS Confessions team
  - Fine-tuned a **RoBERTa**-based hate speech detection model using Hugging Face.
  - Addressed the issue of **code-mixing** by replacing Hindi and Hinglish words with their English equivalents to avoid retraining encodings.

Course Projects

- **Vision Transformers (Neural Network and Fuzzy Logic)**: Implemented Vision Transformers from Scratch using **Pytorch** and **OpenCV**. Trained on the **cassava leaf disease detection dataset**. Prepared and presented a report on the workings of ViT. (Selected among top 5 projects in 41 projects)
- **Text Summarisation (Deep Learning)**: Explored **Extractive** and **Abstrative** text Summarisation techniques. Studied and implemented techniques such as **text rank, text teaser, and latent semantic analysis** for extractive text summarisation. Implemented **BART models and Seq2Seq networks** for abstractive text summarisation.
- **Age Invariant Face Recognition (Deep Learning)**: Contributed to the collection of data (25 images from 6 movies spread across 30 years for each actor for 4 actors). Used **CLAHE** technique for image enhancement and **SIFT, ORB and AKAZE** for feature extraction. Compared results by plotting **ROC** curves
- **A Consciousness-Inspired Planning Agent for Model-Based Reinforcement Learning (Deep Learning - Term Paper)**: Prepared report and delivered presentation to peers in the course.
- **Design and simulation of a ANN-based control of an inverted pendulum (Industrial Instrumentation and Control)**: Designed the model of a **non-linear inverted pendulum** in **MATLAB** and **Simulink**. Implemented a **Neural Network Controller block** in Simulink. Trained parameters to stabilise system. **Reduced stabilisation time** as compared to previous papers.

Teaching

- **Head Teaching Assistant** — Pilani, India
  Neural Network and Fuzzy Logic — *Aug 2022 - Dec 2022*
  - **Heading** a team of 12 Teaching Assistants
  - Ideated and prepared 4 assignments covering Introduction to ML, Computer Vision, Natural Language Processing and Reinforcement Learning
  - Supervised and conducted evaluations for the final projects(Research paper Implementation)
  - Conducted lectures alongside the course instructor
- **Teaching Assistant** — Pilani, India
  Neural Network and Fuzzy Logic — *Jan 2022 - May 2022*
  - Prepared and evaluated **assignments** of 120 students
  - Conducted lectures on **Numpy** and **Pandas** which had an attendance of **84 students**
  - **Handheld** 3 teams (9 students) in preparing their **final course projects**

Co-Curricular and Volunteering

- **Co-Organiser DSARex** — Kaiserslautern, Germany
  DSA, DFKI — *Jan 2024 - Present*
  - Helped **initiate** and **organise** sessions for the DSA Research Exchange Group
  - Conducted a session on **Active Learning methods**
- **Co-Organiser** — Kaiserslautern, Germany
  Causal Reading Group MLGH — *Jan 2024 - Present*
  - Founding member and Co-organiser of the **Causal Reading Group** Spread across multiple institutions
  - Presented session on **Independent Mechanism Analysis** and **Object Centric Representation Learning**
  - Presented chapter on **Multivariate Causal Models** from **Elements of Causal Inference**
- **Chair** — Pilani, India
  BITS ACM — *Aug 2022 - Jul 2022*
  - **Lead** the Executive committee
  - Conducted a **lecture** on **Causality and Diffusion Processes**
  - Initiated 4 major projects in cybersecurity, blockchain, machine learning and development
- **Special Interest Group Coordinator** — Pilani, India
  BITS ACM — *Jul 2021 - Jul 2022*
  - Organised and conducted **hackathons** on **Reinforcement Learning**
  - Managed and supervised the conduction of multiple events including **Competitive Coding**, and lectures on **various CS topics**
  - Managed **recruitment** and **on boarding** of the junior members
- **Machine Learning SIG Coordinator** — Pilani, India
  BITS ACM — *Aug 2020 - Jul 2021*
  - Conducted a **lecture series** on **Reinforcement Learning**
  - Prepared **recruitment tasks** for the Machine Learning SIG
  - Provided **guidance** to the junior batches on **projects** involving Computer Vision and NLP