Mainak Sarkar

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Education

Texas A&M University, College Station (GPA: 4/4) **Aug 2024 - Aug 2028**
Ph.D. in Computer Science *College Station, TX*

- **Core Courses**: Software Engineering, Cloud Computing, Analysis of Algorithms
- **Additional Courses**: Deep Reinforcement Learning, Machine Learning for 3D Vision

University of California, San Diego (GPA: 3.975 / 4) **Sep 2022 - Jun 2024**
M.Sc. in Machine Learning and Data Science *San Diego, CA*

- **Core Courses**: Statistical Machine Learning, Probability and Statistics, Linear Algebra
- **Additional Core Courses**: Deep Generative Models, Computer Vision, Convex Optimization and Applications
- **Technical Electives**: Introduction to Deep Learning, Search & Optimization

Jadavpur University (GPA: 9.24 / 10) **Jul 2017 – Jun 2021**
B.Eng. in Electrical Engineering *West Bengal, India*

- **Main Courses**: Digital Signal Processing, Object-Oriented Programming, Control Systems, Complex Analysis, Numerical Linear Algebra, Vector Algebra, Differential Equations
- **Special Electives**: Communication Theory and Computer Networks, Convex Optimization, Power Systems

Industry Experience

Amazon **Jun 2023 – Sep 2023**
Software Development Engineer Intern *Phoenix, AZ*

- Designed an innovative ***No-Code tool*** that enables software developers to ***create and modify title webpages*** within the ***Seller Central*** platform using a simple ***drag-and-drop*** approach.
- Developed various ***widgets***, including the ***Sticky-Header*** and ***Image-Modal***, using ***JavaScript*** and ***React***, and integrated them into the ***No-Code tool***.
- Established a ***Content Delivery Network-based Backend Service*** using ***AWS CDK***, for publishing webpages created with the ***No-Code tool*** on the Seller Central platform.
- The designed ***No-Code tool*** yielded significant enhancements in ***landing page deployment efficiency***, reducing ***initial deployment time*** to ***1 week*** and ***minor revisions*** to a mere ***15 minutes***.

Haldia Energy Limited **Jul 2021 – Mar 2022**
Engineering Executive *West Bengal, India*

- Worked both as ***a field and desk engineer*** in the ***Main Plant Operations (MPO)*** department, that deals with the monitoring and regulation of the operation of the ***Boiler-Turbine-Generator (BTG)*** section of the power plant.
- Assisted in the implementation and deployment of an ***efficient Machine Learning model*** for predicting the settings of system parameters such as ***Force Draught Fan speed*** and ***Coal Feed rate*** for achieving ***optimal power generation***.

Calcutta Electric Supply Corporation Limited **Jun 2020 – Aug 2020**
Signal Processing Intern *West Bengal, India*

- Developed a **novel approach** based on ***Welch's power spectral density estimation*** method, to accurately determine the ***duration*** and **dominant frequency** of ***power swings*** from ***Phasor Measurement Unit data***.
- Extensively experimented on ***CESC's databases*** to confirm the ***effectiveness*** of my approach, obtaining an average accuracy of ***98***% and a ***200-ms*** faster response time compared to ***Frequency Protection Relays***.

Research Experience

Prof. Suryansh Kumar's Laboratory, Texas A&M University **Aug 2024 – Present**
Graduate Research Assistant — Computer Vision, Reinforcement Learning, Robotics *College Station, TX*

- Developing a ***novel uncertainty-guided framework*** for ***active 3D reconstruction*** that leverages both ***geometric*** and ***image rendering uncertainties*** to optimize ***viewpoint selection*** and ***improve reconstruction accuracy***.
- Conducting systematic literature review of ***Next-Best-View (NBV) selection methods*** in active 3D reconstruction, analyzing state-of-the-art techniques and identifying key research directions.

Advanced Robotics and Controls Laboratory, UC San Diego **Feb 2023 – Sep 2023**

Research Assistant — Computer Vision, Deep Learning *San Diego, CA*

- Assisted in the development of a ***novel tokenization method*** based on ***attention-maps***, that appreciably enhances the ***performance*** of well-known ***vision transformer models*** used for ***depth estimation*** in surgical videos.
- Prepared a ***broad literature review*** of token ***pruning***, ***restructuring*** and ***clustering techniques***, and performed an extensive comparative analysis between the state-of-the-art ***tokenization methods***.
- ***Consolidated***, ***processed***, and ***annotated*** a surgical database of ***2000 images*** for a ***surgical tool-tip tracking project***.

Prof. Ram Sarkar's Lab, Jadavpur University **Mar 2021 – Jan 2022**

Student Researcher — Multimodal Deep Learning *West Bengal, India*

- Engineered a ***non-linear fuzzy-ensemble*** of neural networks for accurate ***human activity detection*** from wearable sensors' data.
- Introduced and incorporated a ***novel constrained penalization logic***, that ensures ***correct prediction*** even in the case of ***misclassification*** by one or more (less than 50%) of the ***constituent networks*** of our ensemble.
- Our proposed ensemble ***outperformed*** the ***state-of-the-art models*** by achieving an average of ***3% higher weighted F1-score*** on ***4 widely-used Human Activity Recognition datasets***.
- Incorporating a ***minor change*** in the ***architecture*** of a ***constituent network*** of our ensemble, we managed to ***reduce training time by*** 10%, while ***still maintaining accuracy*** close to that of the ***state-of-the-art models***.

Machine Intelligence Unit, Indian Statistical Institute **Mar 2020 – Oct 2021**

Research Intern — Unsupervised Learning, Topology *West Bengal, India*

- Developed a novel ***Embedding Quality Assessment*** (EQA) method for providing ***robust*** evaluations of the ***quality of low-dimensional representations*** generated by ***Manifold Learning algorithms***.
- Our proposed ***EQA method*** can accurately quantify both the ***global and local structure preservation*** of the ***topology of high-dimensional data*** in their corresponding low-dimensional representations.
- Experimented on multiple ***synthetic and real-life datasets***, and demonstrated that the proposed EQA approach is significantly more ***reliable*** and ***robust*** compared to current state-of-the-art methods.

Independent Project, Jadavpur University **Mar 2020 – Sep 2020**

Student Researcher — Deep Learning, Computer Vision *West Bengal, India*

- Pursued an independent project, with an objective to ***design a machine-learning model*** that can perform accurate ***monocular depth estimation*** of both ***indoor and outdoor scenes***.
- Our research culminated in the proposal of a ***transfer learning-based novel encoder-decoder model*** and a ***tailored loss function***, with which we obtained ***6% higher threshold accuracy*** and ***12% lower root mean squared error*** than the state-of-the-art methods.

Research Publications

- ***MEQA: Manifold Embedding Quality Assessment via Anisotropic Scaling and Kolmogorov-Smirnov Test***, in Pattern Recognition, Elsevier (2023). (**Paper Link**)
- ***NoFED-Net: Non-Linear Fuzzy Ensemble of Deep Neural Networks for Human Activity Recognition***, in the IEEE Internet of Things Journal (2022). (**Paper Link**)
- ***Monocular Depth Estimation Using Encoder-Decoder Architecture and Transfer Learning from Single RGB Image***, at the 2020 IEEE 7th UPCON. (**Paper Link**)

Technical Skills

Languages/Frameworks: Python, C/C++, MATLAB, Ruby, JavaScript, React, SQL
Developer Tools: Git, VS Code, PyCharm, Jupyter Notebook, IntelliJ IDEA
Libraries: PyTorch, TensorFlow, OpenCV, Keras, Scikit-learn, NumPy, SciPy, Matplotlib, Pandas