MONI SHANKAR DEY

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EDUCATION

Institute	Degree	CGPA	Year
IIT Bombay	M.Tech.	9.58	2020
Presidency University	M.Sc.	7.21	2017

ACADEMIC THESIS

M.Tech.: Attention Morph-UNet for Road & Building Extraction from Satellite Images *[2020]*
M.Sc.: Simulating Foregrounds for Redshifted HI 21 cm Signal Study of Epoch of Reionization (EoR) *[2017]*

RESEARCH PUBLICATIONS

Dual-Path Morph-UNet for Road and Building Segmentation From Satellite Images *[2021]*
Journal: Geoscience and Remote Sensing Letters (IEEE)
Authors: **Moni Shankar Dey**, Ushashi Chaudhuri, Biplab Banerjee & Avik Bhattacharya

- Designed novel **DPM-UNet** for aerial object segmentation based solely on their **morphological** features.
- Incorporated residual & dense path in UNet architecture resulting in **reduced redundancy** & small model size.
- Achieved state of the art (SOTA) on road & building segmentation while having **90%** less parameters (**0.45 mil.**)

Image Restoration by Learning Morphological Opening-Closing Network *[2020]*
Journal: Mathematical Morphology -Theory and Applications (De Gruyter)
Authors: Ranjan Mondal, **Moni Shankar Dey** & Bhabatosh Chanda

- Designed **Alternate Sequential Filter** based morphological network for de-raining and de-hazing images.
- **Reconstructed** de-hazed image by estimating airlight and transmittance map using **joint DSSIM** loss.
- Achieved **SOTA** on O-HAZE, D-HAZY, and Rain dataset for **de-hazing** & **de-raining** tasks respectively.

Open-Set Identification of Minerals from CRISM Hyperspectral Data *[2024]*
Journal: International Geoscience and Remote Sensing Symposium (IEEE)
Authors: Sandeepan Dhoundiyal, **Moni Shankar Dey**, Shashikant Singh, P. V. Arun, G. Thangjam & Alok Porwal

- Proposed **EVMF**, combining Random Forests & Extreme Value Analysis to identify minerals in **CRISM** data.
- Achieved state of art accuracy of **87%**, kappa score of **0.85** & detected **89% outliers**, on Open Set test data.
- Quantified model's **interpretability** using **SHAP**, and compared it with spectra's physically significant features.

WORK EXPERIENCE

56Secure *Bangalore*
Senior Machine Learning Engineer *[May'24 - Present]*

- Led development of **tracker** algorithm; introduced **historical matching**, improving **accuracy** by **5%**.
- Spearheaded **refactoring** of the tracker codebase, accelerating debugging and development cycles.
- Designed and implemented **performance metrics** for the object reidentification model & tracker algorithm.
- **Architected** object detection & re-identification annotation process using **LabelStudio** & MLFlow
- Synced with annotators & product team to create **in-house vehicle dataset** for model benchmarking.
- **Mentored** junior team members on code best practices; conducted **interviews** to expand and strengthen team.

SigTuple Technologies *Bangalore*
Data Scientist - II *[Oct'23 - May'24]*

- **Leading** a 3 member team, as a **SPOC**, for a collaborative inter-company **Point of Care (POC)** device project.
- **Simulated** scenarios for device resource usage, & **benchmarked IP and DL** algorithms to check device capacity.
- Streamlined existing detection pipeline & increased inference speed by **12x** on **NVIDIA-Jetson Nano**.
- **Architectured** & implemented a **test-driven pipeline** for model inference, considering the device's constraints.
- Developed **NATS** messaging for **async** inter-module communication, & **dockerized** code for on-edge deployment

Data Scientist - I *[Apr'22 - Sep'23]*

- **Owner** of **Malaria module** - designed pipelines for data annotation, model training & inference on PBS images.
- Synced with product & medical team to define **KPI** & **develop strategy** to detect **malaria** at **40x** magnification
- Implemented basic **active learning** pipeline, leading to **67% reduction** in **annotation** time by doctors.

- Scraped and **mined in-house database** to identify potential malaria samples & add **hard negatives**.
- Applied **self supervised learning** & **clustering** to improve diversity and **reduce imbalances** in training data.
- Designed **YOLOX** based 3-stage model & finetuned over 2 iteration, achieving **23% improvement on F1** score
- Productionized the inference pipeline, and deployed it on GCP post dockerization.
- Improved IP based 40x RBC classification model with **ECA-ResNet** based model for **stain variation** robustness
- Investigated product complaints, and **refactored** existing codebase to be reliable & **resilient to edge cases**.
- Documented and conducted **device-wide tests** post system releases, as part of the **regulatory** framework.

Rakuten Mobile (Innoeye) *Tokyo (Remote)*
Software Engineer *[Nov'20 - Apr'22]*

- Part of 30+ member team responsible for developing **Rakuten Link**, Rakuten Mobile's flagship app
- Entrusted with developing **Proof of Concepts (PoC)** & features for Voicemail, Greetings and Call sections
- Implemented unit **test case** for code robustness, including edge cases, usability & general reliability
- Collaborated closely with cross-cultural product & UI teams across the time zones under agile methodologies

Indian Statistical Institute *Kolkata*
Machine Learning Research Intern *[May'19 - Aug'19]*

- Investigated image processing operations and ways to incorporate them in deep learning based framework
- Developed **morphological** neural network (MNN) for **style transfer** & pencil sketch on MIT Adobe Dataset
- Designed **Deep-MNN** to estimate crowd strength & achieved **18.3%** accuracy improvement over MC-CNN.

SustLabs *Mumbai*
Data Science Intern *[Dec'18 - Jan'19]*

- Extensive survey of machine learning methods for detecting real time **appliance activity** using **NILM**
- Responsible for building training and test **dataset** of **30+** home and industrial appliances in market.
- Developed analytical model to detect **appliance signature** from smart meter aggregate load data using **R**

SELECTED PROJECTS

Hourly Micro-Climatic Parameter Forecasting using Deep Learning

- Performed EDA & removed trend and non stationarity from micro climatic **time series IoT data**
- Extracted **multiple seasonalities** using Fourier transform & utilized it as exogenous variables in ARIMA model
- Developed model consisting of 1D CNN & achieved **23% lower MAPE** compared to ARIMA for hourly forecast

Myocardial Infarction detection using Deep Learning

- Designed a novel 11 layer deep network consisting of **1D CNN** for analyzing raw **ECG** signals
- Pre-processed and de-noised the raw signal by applying **SG filter** and **CP Detection** algorithm
- Executed the network in PyTorch over **PTB Diagnostic ECG** dataset and achieved accuracy of **97.89%**

TECHNICAL SKILLS

Tools: Git, CircleCI, Docker, NATS, GCP, MongoDB, NoSQL, Firebase, LabelStudio, MLFlow
Languages: Python, R, Cython, Swift, C, Kotlin, Java
ML Frameworks: TensorFlow, PyTorch, Keras, CoreML, Huggingface, FastAPI, ONNX
Remote Sensing: ENVI, ArcGIS, QGIS, Google Earth Engine

SCHOLASTIC ACHIEVEMENTS

- **Academic Reviewer** - Earth Science Informatics (Springer) *[Impact Factor - 2.705]* *[2023 - Present]*
- Selected for **PhD** in **Physics** at **Tata Institute of Fundamental Research** (TIFR) *[2018]*
- Awarded **Junior Research Fellowship** in **Physics** for securing **AIR 142** in **CSIR-UGC NET** *[2017]*