

Dipam Chakraborty

✉ chakraborty.dipam@gmail.com | 🏠 dipam.in | 📷 dipamc | 🌐 dipamc | 🐦 __dipam__

Education

NATIONAL INSTITUTE OF TECHNOLOGY, ROURKELA - 5 YEAR B.TECH + M.TECH DUAL DEGREE

July 2013 - June 2018

Master of Technology in Electronics and Communication Engineering - CGPA 8.73/10

Bachelor of Technology in Electronics and Communication Engineering - CGPA 8.35/10

Experience

ALCROWD - MACHINE LEARNING ENGINEER

January 2021 - Present

- **Alcrowd Research** - Contributed to nearly all aspects related to applied machine learning in research projects with both industry and academic collaborators. Performed literature survey to assess benchmarks for challenges on Alcrowd. Managed two full-time employees and three interns. Here are some details of notable research projects:
 - **MABe Supervised Learning** - MABe is a project on classifying Multi-Agent Behaviors using deep learning. I designed and ran LSTM and 1D CNN experiments extensively used in the paper. Also investigated In collaboration with Northwestern University and Caltech.
 - **MABe Unsupervised Learning** - Further extended MABe to use unsupervised learning (contrastive learning and masked prediction).
 - **RogRL** - Designed a reinforcement learning environment and performed extensive experiments to investigate the usage of deep learning for vaccination strategies. In collaboration with EPFL Switzerland.
 - **Flatland** - Flatland is a reinforcement learning environment designed for multi-agent reinforcement learning on trains. I made major design decisions for updates made to Flatland for new functionality and improved API.
- **Organizing Competitions** - Responsible for consultation, formulation, setting up, testing, management, and post-competition reviews for multiple research competitions based on deep learning and reinforcement learning. Notable ones being Interactive Grounded Language Understanding (IGLU), Citylearn, Multi Agent Behavior Challenge (MABe), Flatland 3, Nethack, Deepracer, Data Purchasing Challenge, among others. Also wrote competition proposals for NeurIPS 2021 and 2022.
- **Alcrowd evaluation infrastructure** - Tested and contributed to Alcrowd's evaluation infrastructure, which is used for a diverse set of ML competitions. Setup a generalized tournament orchestration library, to be used for multi-agent game-based competitions.
- **Snail Classification web app** - Supervised and contributed to the development of a snail classifier web app in collaboration with World Health Organization. Field workers and doctors use the web app to identify poisonous snails.

INTEL - MACHINE LEARNING ENGINEER

July 2018 - January 2021

- **Defect Detection with unsupervised learning** - Contributed to the development of a solution for defect detection on small automobile parts, with deep unsupervised learning based on a CNN Autoencoder. The model learns to reconstruct only good parts and poorly reconstructed parts are marked as defective.
- **3D Defect Detection with robotic manipulator** - The autoencoder-based solution is limited to parts with only one surface. To extend the solution to complex 3D parts such as motorbike fuel tanks, a robotic manipulator maps the surface of the part as with multiple ML solutions working in conjunction for 3D defect detection. The system was eventually deployed at a fuel tank factory.
- **Design of Graph Neural Net hardware accelerator** - Surveyed current literature for Graph Neural Network (GNN) algorithms and accelerator designs. Worked on initial design stages of hardware for highly sparse matrix operations for GNNs.

INTEL - INTERN

December 2017 - June 2018

- **CNN optimization and implementation on FPGA** - Trained and pruned CNN for high speed optical character recognition while maintaining performance. Implemented custom 8 bit layers in SystemVerilog for significant compute savings. Contributed to OpenCL FPGA implementation of CNN. Contributed to real world demo presented integrating FPGA, camera and a miniaturized conveyer belt.

TEACHING

- **Teaching Assistant** - Signals and Networks – Image Processing and Computer Vision Laboratory – Circuit Simulation Laboratory
- **Underwater Robotics Workshop** - Organized, prepared teaching material, and taught a group of 30 students on underwater robotics
- **C.R.E.A.T.E** - Taught and organized basic robotics and embedded systems to freshers as part of robotics and automation society

Projects

THESIS - INERTIAL AND VISUAL NAVIGATION SYSTEMS FOR AUTONOMOUS VEHICLES

May 2017 - June 2018

Supervised by Dr. Siddharth Deshmukh, Dr. Sarat Kumar Patra, and Mr. Srajudheen Makkadayil

- Implemented an inertial navigation system(INS) on a mobile robot, collected INS data and ground truth with encoder and magnetometer.
- Fitted a neural network to augment the sensor fusion for INS. This was combined with a redundant IMU unit for noise filtering.
- Worked on a visual mapping system to further augment the the navigation system. The entire system was integrated on an FPGA platform.

TIBURON - AUTONOMOUS UNDERWATER VEHICLE

March 2015 - May 2018

Supervised by Dr. Haraprasad Roy

- **Vice Captain** - Led the team at one domestic and one international competition and achieved top ranks in both.
- **Computer Vision and Sensor Fusion** - Developed the computer vision subsystem from scratch. This was especially challenging due to the inability to use GPS underwater. The system did not use deep learning due to compute constraints at the time.
- **Control Systems** - Contributed the design and implementation of the control system based on combining multi-rotor outputs in 3D space.
- **Electronics Subsystem** - Designed, fabricated, and integrated the entire electronics stack for the first vehicle.
- **Founding member** - As one of the first members of the team and I was involved in the development of the entire vehicle from scratch.

Achievements

Currently I'm a Kaggle Competitions Master

- 2023 **3rd/812 teams**, Kaggle: IceCube Neutrinos in Deep Ice - Also awarded one of five best write-ups
- 2020 **3rd/736 participants**, NeurIPS 2020: Procggen Competition - Deep Reinforcement Learning
- 2019-20 **2 Silver Medals in competitions**, Kaggle - Severstal Steel Defect Detection— Bengali AI Grapheme Identification
- 2018 **2nd/46 International Teams**, Singapore Autonomous Underwater Vehicle Challenge — First Indian team to win in top 3
- 2015-16 **1st Position in multiple competitions**, Won three robotics competitions at premier institutions in the country

Machine Learning Competitions

I put significant effort when participating in competitions, always learning something new, and sometimes winning.

KAGGLE - ICECUBE NEUTRINOS IN DEEP ICE - 3RD POSITION - SOLO GOLD WINNER

2023

Used a custom transformer-based model, with a heavily optimized training pipeline written completely from scratch. Designed multiple training objectives and ensembled transformer predictions using XGBoost, mixing deep learning with decision trees, which is uncommon.

AICROWD - NEURIPS 2020 - PROCGEN COMPETITION - 3RD POSITION

2020

Developed a custom variant of the deep reinforcement learning algorithm PPO with a replay buffer. Eventually adapted my changes with another algorithm from OpenAI (Phasic Policy Gradient), which was released on the same month as the competition.

KAGGLE - BENGALI AI GRAPHEME IDENTIFICATION - SILVER MEDAL

2020

Used domain knowledge to develop a custom rule based augmentation system for Bengali Grapheme generation.

KAGGLE - SEVERSTAL STEEL DEFECT DETECTION - SILVER MEDAL

2019

Adapted state-of-the-art instance segmentation algorithms for the competition. Also developed a custom loss for the noisy data of steel defects.

Contributions

CLEANRL - CONTRIBUTED PHASIC POLICY GRADIENT (PPG) IMPLEMENTATION

May 2022

Contributed the Phasic Policy Gradient algorithm to CleanRL, which is a popular reinforcement learning library. Matched the specific implementation details from the original algorithm by OpenAI, not mentioned in the paper, but affects performance significantly.

FLATLAND - DESIGNED INTERNAL STATE MACHINE

May-July 2021

Designed a new state machine to standardize the internal flow of Flatland, which was originally a lot of patched up conditions. The aim was to provide cleaner interface to researchers and participants as understanding the internals of the environment is often necessary.

Computer Skills

Languages • Python **Libraries** • Pytorch • Tensorflow • OpenCV • Pandas **Software** • Docker • Kubernetes
Strengths • Computer Vision • Pipeline Optimization • Data Analysis • Automation • Deep learning fundamentals

Publications

- [1] Shengyi Huang, Rousslan Fernand Julien Dossa, Chang Ye, Jeff Braga, **Dipam Chakraborty**, Kinal Mehta, and João G.M. Araújo. "CleanRL: High-quality Single-file Implementations of Deep Reinforcement Learning Algorithms". In: *Journal of Machine Learning Research* 23.274 (2022), pp. 1–18. URL: <http://jmlr.org/papers/v23/21-1342.html>.
- [2] Bakshree Mishra, **Dipam Chakraborty**, Srajudheen Makkadayil, Saurabh D. Patil, and Bhaskar Nallani. "Hardware Acceleration of Computer Vision and Deep Learning Algorithms on the Edge using OpenCL". In: *EAI Endorsed Transactions on Cloud Systems* (2019). DOI: 10.4108/eai.5-11-2019.162597.
- [3] Sharada Mohanty, Jyotish Poonganam, Adrien Gaidon, Andrey Kolobov, Blake Wulfe, **Dipam Chakraborty**, Gražvydas Šemetulskis, João Schapke, Jonas Kubilius, Jurgis Pašukonis, et al. "Measuring sample efficiency and generalization in reinforcement learning benchmarks: Neurips 2020 procgen benchmark". In: *arXiv preprint arXiv:2103.15332* (2021).
- [4] Jennifer J Sun, Tomomi Karigo, **Dipam Chakraborty**, Sharada Mohanty, Benjamin Wild, Quan Sun, Chen Chen, David Anderson, Pietro Perona, Yisong Yue, and Ann Kennedy. "The Multi-Agent Behavior Dataset: Mouse Dyadic Social Interactions". In: *Proceedings of the Neural Information Processing Systems Track on Datasets and Benchmarks*. 2021. URL: <https://datasets-benchmarks-proceedings.neurips.cc/paper/2021/file/7f1de29e6da19d22b51c68001e7e0e54-Paper-round1.pdf>.
- [5] Jennifer J. Sun, Andrew Ulmer, **Dipam Chakraborty**, Brian Geuther, Edward Hayes, Heng Jia, Vivek Kumar, Zachary Partridge, Alice Robie, Catherine E. Schretter, Chao Sun, Keith Sheppard, Param Uttarwar, Pietro Perona, Yisong Yue, Kristin Branson, and Ann Kennedy. *The MABe22 Benchmarks for Representation Learning of Multi-Agent Behavior*. 2022. DOI: 10.48550/ARXIV.2207.10553. URL: <https://arxiv.org/abs/2207.10553>.