

# Dipam Chakraborty

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## 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

- **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.
- **Alcroud Research** - Provided consultancy to external organizers for machine learning aspects of multiple projects. Performed literature survey to assess benchmarks for challenges on Alcroud. Managed two full time employees and three interns.
- **Alcroud evaluation infrastructure** - Tested many features and improved Alcroud's evaluation infrastructure v2.0. Setup a generalized tournament orchestration library, to be used for multi agent game based competitions.
- **Flatland** - Flatland is a RL 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.
- **Snail Classification web app** - Supervised and contributed to development of a snail classifier web app in collaboration with World Health Organization. The web app is used by field workers and doctors to identify poisonous snails.

### INTEL - MACHINE LEARNING ENGINEER

July 2018 - January 2021

- **Defect Detection with unsupervised learning** - Contributed to development of a solution for defect detection on small automobile parts with deep unsupervised learning based on a CNN Autoencoder. The algorithm does not require labelled examples of defective parts. The autoencoder 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.
- **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.

### TEXAS INSTRUMENTS - INTERN

May 2016 - July 2016

- **Circuit Design Automation** - Implemented genetic algorithm for selecting among different topologies of multistage amplifier design. Also implemented a GUI to select the input parameters and constraints, then visualize and compare the results.

## 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.

## Contributions

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### 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 code by OpenAI, which are not mentioned in the paper and are easy to miss, but affect 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.

### REVIEWER - NEURIPS 2022 DATASET AND BENCHMARKS TRACK

June-July 2021

Reviewed 3 reinforcement learning benchmark papers for NeurIPS 2022 Dataset and Benchmarks track.

## Achievements

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- 2020     **3rd/82 teams**, NeurIPS 2020: Procgen 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

## Computer Skills

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**Languages** • Python    **Libraries** • Tensorflow • Torch • Pandas • Numpy    **Software** • Docker • Adobe Illustrator

## Publications

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- [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>.