# Soumyadip Sarkar

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## Education

**Institute of Engineering and Management, Kolkata** **2018 - 2022**

*Bachelor of Technology in Electrical Engineering* *Kolkata, West Bengal*

## Experience

**IIITD Autonomous Last Mile Vehicle (ALIVE)** **July 2022 – Present**

*Research Associate under Dr. Saket Anand and Dr. Sanjit K. Kaul* *New Delhi*

- Integrated a **logitech racing wheel** with Carla simulator.
- Later on I created **Carla scenarios** for testing the planning and control stack.
- Wrote a Bash script that runs the entire control and planning stack with different experiments using a single command, saving time from a cumbersome and time-consuming task.
- Designed and developed a **Forward Collision Warning (FCW) system** with Integrated Advanced Emergency Braking Systems **(AEBS)** maintaining the AIS standards. The project involved **YOLOv5** object detection, tracking, and applying kinematic laws. The pipeline was designed for Carla simulator using ROS.
- Integrated a **Conventional Cruise Control (CCC)** system using the existing Planning and Control stack with FCW in Carla to demonstrate the scenario-based working of FCW.
- Designed and developed a **Traffic Light Warning (TLW) system** for the Carla simulator using ROS. I collected synthetic (10k) and real-world data (8k) and trained an **unsupervised model, GMM** for traffic light color classification, which resulted in approximately 96% test accuracy.
- I worked on a unique idea of an **XR test-bed**, which involved creating an RViz-based interface for spawning and visualizing static and dynamic obstacles. I also created a **C++ ROS package** to publish the position of these obstacles to the estimator.
- As a part of XR test-bed I worked on **adding obstacles at the camera level** which involved using camera-lidar calibration and re-rendering the camera frames by taking segmented image of obstacle from carla while moving the ego vehicle according to real car's position.
- Conducted a literature review on **Perception Failure for Object Detection** and **testing ADAS systems in a simulation environment**

**University of New South Wales, Australia** **April 2022 - May 2022**

*Research Internship under Ph.D. student Tanmoy Dam* *Remote*

- Worked on prior learning for GAN which involved working on **Elastic InfoGAN** and **Barlow Twins** to counter the incoherent grouping problem that arises because of imbalance data.

**Indian Institute of Technology, KGP** **January 2021 - April 2021**

*Machine Learning Intern under Dr: Debashish Chakravarty and Ph.D. scholar Tamesh Halder* *Remote*

- Collected, annotated, and preprocessed satellite data from two locations (Rosamand and Palmdale) to segment landscapes containing hills, buildings, and water bodies.
- Trained **Mask R-CNN with ResNet50 and ResNet101** backbones using various augmentation methods, achieving 86% pixel accuracy.
- Utilized **KL-Divergence and K-Means** to perform urban image segmentation, with a focus on identifying buildings. Our work was published at ICORT, 2021.

## Projects

**HuBMAP + HPA: Multi-organ FTU segmentation** | *Pytorch, timm*

- **Problem statement:** Semantic segmentation of 5 imbalanced medical tissue types using only 351 high-resolution images from 2 different train-test sources.
- Initial baseline: Unet and Unet++ on normal and patch image training.
- Worked on a **custom augmentation pipeline** with custom function for specific augmentations. Also used proper experiment logging with WandB and log files.
- Switched to **Swin Transformer Tiny with Uppernet decoder**, improving results to 0.7 LB. Experimented with different training resolutions, half precision, and gradient accumulation.
- Trained **Coat + DAFormer decoder** with 3 different folds, which resulted more better results(0.75LB).
- Annotated extra 30 images downloaded from HuBMAP site using labelme.

- Some tricks that worked, using transpose of the mask, matching the pixel size of HPA w/ HuBMAP, using focal loss as auxiliary loss, stain normalization.
- SWA based ensembling for same model of different folds and then using TTA on different models.

**Tensorflow-GBR Starfish Detection** | *Python, pytorch, Ultralytics*

- **Problem statement:** accurately identify starfish in real-time(opt.) by building an object detection model trained on underwater videos of coral reefs.
- Initially used **FasterRCNN with default ResNet50 FPN backbone**, then tried various backbones and hyperparameters with geometric and color augmentation techniques, including ResNet101, ResNet50, EfficientB3, and SwinTransformer backbones.
- Introduced a CLAHE based underwater image enhancement technique for better training.
- Switched to **ultralytics yolov5s6 and yolov5m6 on video based splitting**. I tried different hyper parameters in that, and different training image resolutions. Also tried yolov5 model freezing.
- **Tricks and Post-processing:** Along with yolov5, tracking was doing a better job increasing the CV/LB, using inference time high resolution worked, **TTA and WBF** was used for ensemble. Using classification on bbox helped increase LB.

**Sartorius - Cell Instance Segmentation** | *Pytorch, MMdetection, detectron2, WandB*

- **Problem statement:** segmenting 3 types of neuronal cells in images.
- I started with creating a Unet and **Unet with Attention and residual connection**, but it did not really give any good score. I then moved on to Pretrained Unet model with different backbones [resnet,efficientnet-b2]. Still it was not good enough [0.15+].
- Experimented with mostly two models **Mask RCNN and Mask Score RCNN** from mmdetection, MRCNN gave better results. Experimented with resnet 50 and 101 backbones for MRCNN. Tried detectron2 based MRCNN also.
- Used **NMS** based ensemble with different thresholds for each class.

## Technical Skills

**Languages**: Python, C++, Bash
**Technologies/Frameworks**: Carla, ROS, PyTorch, Tensorflow, Opencv, timm, Detectron2, MMdetection
**Developer Tools**: Git, W&B

## Achievements & Responsibilities

- **4x Kaggle Expert**
- **57th-Silver Medal** in Kaggle TF-GBR
- **62th - Bronze Medal** in Kaggle HuBMAP+HPA
- **214th rank -top 15 Pct.** in Kaggle Sartorius- CIS
- 7th at Octahacks:3 hackathon out of 456 teams
- CORD.ai Community Manager
- Society for Data Science(S4DS) Member

## Publications

- "A Novel Approach for Urban Unsupervised Segmentation Classification in SAR Polarimetry", ICORT, 2021, IEEE
- "COVID-DeepNet: Deep Convolutional Neural Network Architecture Designed for Early Prognosis of COVID-19 Using Post-anterior View of Chest X-Rays", IEM-ICDC 2021, Springer