Parth Shettiwar

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Education

Indian Institute of Technology Bombay — Mumbai, India
Btech. in Electrical Engineering — 2017–Current
Minors in Computer Science and Engineering — *GPA: 9.39/10*
Honors in Electrical Engineering

Publications

- **Size Optimization for Intent Analysis in Voice Commanding**[Paper]
  Parth Shettiwar, *Koushiki Chaudhuri, Ankit Jain, Shivam Goel, Abhirupa Mitra*
  Work Accepted in Short Paper Track at MLADS-Synapse 2020, Microsoft's ML, AI and Data Science conference

Research and Internship Experience

Deep Weakly-Supervised High Speed High Dynamic Range Video Generation[Abstract][Video] — *Mar '20 - Present*
Guide : Prof. Shanmuganathan Raman — *IIT Gandhinagar*

- Devised the first weakly supervised deep learning framework to generate **high Frame Rate High Dynamic Range video** from a sequence of low Frame Rate alternating exposure Low Dynamic Range frames.
- Implemented **Video Frame Interpolation** Technique incorportaing **Depth** and **Flow** estimations to generate multiple high and low exposure LDR frames recursively at each time step.
- Implemented a Novel **Attention-based merge** network for generating HDR video frames using two exposure LDR images. Work was submitted to **SIGGRAPH Asia 2020**.

Few Shot Class Incremental Learning[Architecture][Code] — *July '20 - Present*
Guide : Prof. Subhasis Chaudhuri, Prof. Biplab Banerjee — *IIT Bombay*

- Implemented an encoder-decoder **Nearest mean classfier** in a 5-way, 10 shot setup with Inter class, Reconstruction and Centre loss to achieve **98**% accuracy on omniglot dataset.
- Modelled the prototypes as **Gaussian** to ensure better clustering of samples in latent space to further improve the accuracy.
- Proposed and implemented a novel **GAN** based architecture with **distillation** loss to generate samples of previous classes to avoid **catastrophic forgetting** on complex datasets like Imagenet.

Offline Voice Commanding in Microsoft Word App[Code][Report] — *May '20 - July'20*
Microsoft R&D India/Data Scientist Internship

- Developed and Integrated a **Size Optimized Dynamically Downloadable** Entity Recognizer and Intent Classifier Model for enabling Offline Voice Commanding in Microsoft Word App
- Optimized the size of model by performing an extensive Size vs Accuracy Analysis of in-literature Language Models and achieved a **96**% test accuracy and model size hit incurred of meagre **12kb**.
- Developed a **custom tflite binary** supporting only the operations required by the model bringing its size down from 3.6mb to **268.9 kb**. Work Accepted in Short Paper Track at **MLADS-SYNAPSE 2020**.

Data Generation for Person Intrusion Detection Using Human Pose Transfer [Architecture] — *Dec '19 - Jan '20*
Guide : Prof. Shanmuganathan Raman/Research Internship — *IIT Gandhinagar*

- Proposed a novel **2-way GAN** for Human Pose Transfer conditioned on input image and a target pose.
- Extended the Progressive Attention Transfer Network by proposing **active Foreground and Background losses** to inherently generate target **FG binary masks**, for separately dealing with the FG and the BG paths.
- Used the framework for generating a large number of **fake human images** in different poses and varied backgrounds

***OSR* - Open Set Recognition using Side Information** [Code] — *May '19-July '19*
Guide : Prof. Biplab Banerjee/Resarch Internship — *IIT Bombay*

- Implemented Kernel Null Folley-Sammon Transform(**KNFST**) after learning a Discriminative Dictionary for sparse coding via Label Consistent K-SVD(**LC-KSVD**) to achieve >99.9% training accuracy on MNIST dataset
- Obtained a **latent space** having high discrimination amongst known classes by training a Neural Network upon **Triplet + Reconstruction + Classification** loss with the key features extracted by RESNET as an input
- Generated Pseudo Open Set samples from Open Set Prototypes using a **Conditional Wasserstein GAN**(CW-GAN) with Gradient Penalty trained on closed set visual samples using known **word2vec** prototypes as the condition

Game Theoretic Approach to Optimal Network Allocation[Code][Report] *Jan '20 - Jun '20*
Guide : Prof. Prasanna Chaporkar/R&D *IIT Bombay*

- Modelled and proved the NP-Hard **Optimal Network Allocation** problem as an **exact potential game**
- Proved the existence and uniqueness of the **stationary Gibbs distribution** of the **Markov Chain** defined by **Spatial Adaptive Play Algorithm(SAP) and Concurrent-SAP(C-SAP)**.
- Implementation and Graphical comparison of the convergence of potential functions of 3 Algorithms: **Best Response Dynamics(BRD), SAP and C-SAP** on a simulated aptly **randomized input** to emulate real-world scenario.

Other Technical Projects

Maze Solver *Sept-Oct 2020*
Guide: Prof.Shivaram Kalyanakrishnan | Course (Foundations of Intelligent and Learning Agents) *IIT Bombay*

- Modelled a Maze as a Markov Decision Process with appropriate rewards and transitions.
- Found the shortest path from a given start point to multiple end points in a maze using Value Iteration algorithm.

Chunk Tagger *Aug-Sept 2020*
Guide: Prof.Pushpak Bhattacharyya | Course (Speech, Natural Language Processing and the Web) *IIT Bombay*

- Classified the chunk tags of phrases using a Maximum Entropy Markov Model, Conditional Random field and Bi-LSTM.
- Performed extensive feature engineering incorporating morphological features to achieve >90% accuracy on conll2000 dataset.

Image Inpainting using the Deep Image Prior *Oct-Nov 2019*
Guide: Prof. Biplab Banerjee | Course Project (Machine Learning for Remote Sensing-II) *IIT Bombay*

- Exploited the inherent property of CNN to **reluctantly** fit on a noisy image when started with uniform noise to get off the **Prior term** and reconstruct the original image in a **zero-shot fashion**
- Developed an hour-glass(Encoder-Decoder) architecture with skip connections to maximise the **likelihood** term, subsequently producing the near original image even when **80% of random pixels** are removed.

Adversarial Reprogramming of Neural Networks *Oct-Nov 2019*
Guide: Prof. Ajit Rajwade & Prof. Suyash Awate | Course Project (Digital Image Processing) *IIT Bombay*

- Computed a adversarial perturbation added to all test inputs to reprogramme ImageNet classification model on CIFAR-10
- Illustrated the vulnerability in neural networks performing a adversary chosen task despite being not trained to do it originally

Hyper Spectral Image Classification *Feb '19*
Prof. Biplab Banerjee/Course (Machine Learning for Remote Sensing-I) *IIT Bombay*

- Applied a softmax classifier on kernelized dataset of hyper-spectral images to get a test accuracy of 68% on 16 classes
- Implemented KNN algorithm to increase the test accuracy by 10%

E-Voting using Blockchain *July '19*
Microsoft Codefundo++

- Created a **dApp** in **Geth** framework to build a secure and fast **Electronic Voting system** using **Blockchain** in **Solidity**
- Generated **Transaction ID** for **vote verification** after the voter votes from a region using a **ballot smart contract**

Coherent Optical Receiver *April '19*
Prof. Ashwin Gumasthe/Course Project (Computer Networks) *IIT Bombay*

- Simulated a **Coherent Optical Receiver** in Matlab performing Homodyne and Heterodyne Detection
- Studied the **Quantum Noise** properties of coherent detection

Pipeline Processor IITB RISC *March '19*
Guide : Prof.Virendra Singh /Course Project/ Electrical Engineering Department *IIT Bombay*

- Created a 16 bit **6-stage pipelined processor** based on **Little Computer Architecture** using **VHDL**.
- Implemented **Finite State Machines** for the execution of **15 instructions** with **single and double wide fetch execution**
- Created the **Memory**, **Register** and **Arithmetic Logic** units for storing and computation operations.

Emotion TV *May '18 - Jun '18*
Institute Technical Summer Project, IIT Bombay *IIT Bombay*

- Conceptualized and implemented recognition of two emotions -**Happy** and **Sad** using **Multi-Layered CNN**, to predict the current mood of the person after training on 200+ images dataset
- Speech recognition(using **Google API**), combined with **Text to Speech**(using **gTTS API**) to do nominal conversation

Teaching

- **Teaching Assistant** at IIT Bombay Autumn 2020
Machine learning -II for Remote Sensing (GNR 638)

Scholastic Achievements

- Awarded **AP grade**(Top 1%) for outstanding performance in both **Basic** and **Advance** level courses of **Machine Learning for Remote Sensing**
- Secured **All India Rank 170** in Joint Entrance Exam-Advanced(JEE) with a **perfect score** of **122/122** in Maths *[2017]*
- Recipient of the prestigious **Kishore Vaigyanik Protsahan Yojana (KVPY)** fellowship(SA Stream) with **All India Rank 275** *[2016]*
- Successfully cleared **NSEC** and appeared for **Indian National Chemistry Olympiad(INChO)** *[2016-17]*
- Successfully cleared **NSEA** and appeared for **Indian National Astronomy Olympiad(INAO)** *[2015-16]*
- Recipient of **National Talent Search Examination**(NTSE) fellowship *[2015]*
- Successfully cleared **NSEJS** and appeared for **Indian National Junior Science Olympiad** *[2014]*
- Achieved **International Rank 2** in 2015 and **Rank 3** in 2012 in **National Science Olympiad** conducted by Science Olympiad Foundation.

Technical Skills

- **Programming Languages:** Python, C++, Java, VHDL, HTML
- **Libraries:** OpenCV, Keras, Tensorflow, PyTorch, sklearn, NumPys
- **Software Skills and Circuit Boards:** Android Studio, Quartus, Robot Operating System(ROS), Unity3D git, MATLAB, AutoCAD, SolidWorks, NGSpice, Arduino

Key Courses Undertaken

Machine Learning and applications: Foundations of Intelligent and Learning Agents*, Speech and Natural Language Processing and the Web*, Advance Machine Learning, Machine Learning for Remote Sensing-I, Machine Learning for Remote Sensing-II, Fundamentals of Digital Image Processing

Computer Science :Introduction to Number Theory and Cryptography, Data Structures and Algorithms, Computer and Network Security, Computer Networks, Design and Analysis of Algorithms*

Mathematics and Statistics : A First Course in Optimization, Probability and Random Processes, Data Analysis and Interpretation, Linear Algebra, Differential Equations, Complex Analysis, Multi-variable Calculus, Markov Chain and Queuing Systems, Applied Mathematical Analysis in Engineering*

Electrical : Microprocessors, Electronic Devices and Circuits, Network Theory, Signals and Systems, Analog Circuits, Digital Systems, Power Electronics, Control Systems, Communication Systems, Electromagnetic Waves

** to be completed in 7th semester(December 2020)*

Position of Responsibility

Coordinator | Unmesh Meshruwala Innovation cell *[2017-18]*

- Part of the Localisation subsytem in **SEDRICA:Driverless Car** project at **Innovation cell**, **IITB**
- **Team member** in charge of planning, organizing and publicizing events under **Innovation Cell**
- Organised **Summer Induction Programme** which was attended by 100+ students including topics of mechatronics systems, localisation, path planning, image processing, sensor fusion and machine learninig.

Extra Curricular Activities

- Got Selected and attended the **4th Summer School on Machine Learning** conducted by CVIT, IIIT-Hyderabad *[July'19]*
- **Selected for** and attended the **Inter IIT Table Tennis Camp** (The top 7 in institute) *[Nov-Dec '18]*
- Won **Bronze medal** in the General Championships of **Inter Hostel Table Tennis** open representing hostel and recognized as **Player of the Tournament** for the exceptional performance throughout *[2017]*
- Recognised as one of the **best presenters** on **Large Systems** and **Mathematics in Electrical Engineering** to students who came from different colleges of India under **TEQIP III**, an initiative by MHRD *[2018]*
- Stood **1st** in **Physics Bazinga**(2018) and **3rd** in **Maths Bazinga**(2017) - Institute open Maths and Physics Competition of puzzling problems conducted by Maths and Physics Club
- Awarded **Champion of Champions Trophy** in All India **Vedic Maths** competition conducted by Ideal Play Abacus *[2013]*