Advait Kumar

Curriculum Vitae

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Education

2018–Present **B Tech (Honors)**, *Department of Electrical Engineering, Indian Institute of Technology, Bombay, Mumbai, India - GPA 9.05/10.0.*

2018–Present **M Tech**, *Department of AI & Data Science, Indian Institute of Technology, Bombay, Mumbai, India.*

2018 **Intermediate**, *PACE Junior Science College, Andheri, India - 90.71%.*

2016 **Matriculation**, *CNM School, Mumbai, India - 96.60%.*

Research Interests

- Deep Learning
- Computer Vision
- Image Processing
- Reinforcement Learning

Research Experience

Jan 2021 - July 2021 **Adversarial Image Inpainting** | Research Project

Guide: *Prof. Biplab Banerjee, Department of AI and Data Science, IIT Bombay*

- Studied and implemented various Adversarial Image Inpainting Deep Learning models on PyTorch such as GLCIC, EdgeConnect, PartialConv
- Proposed a new model, RSINet, which includes Attention Modules, Skip Connections and GANs as its basic blocks
- The model is trained using a combination of L_1, Adversarial, Perceptual and Style losses
- The model outperforms the current state of the art image inpainting models on various types of ablations, namely Rectangular, Gaussian & Irregular Masks on the UC-MERCED & Open Cities AI datasets
- Work submitted in the **IEEE IGARSS 2022** conference

Sep 2021 - present **Incremental Zero Shot Learning** | B.Tech Project

Guide: *Prof. Biplab Banerjee, Department of AI and Data Science, IIT Bombay*

Co-Guide: *Prof. Fabio Cuzzolin, Computer & Mathematics, Oxford-Brookes University*

- Proposed a novel model, IncreNet, which mitigates the catastrophic forgetting encountered while training an incremental zero shot learning model for video action recognition
- Uses a ResNet-101 architecture pretrained on ImageNet to extract features from the video that are passed through a classifier for determining the actions in the video
- A GAN conditioned on the concatenated features obtained using gaussian noise and the word2vec representation of the video caption is simultaneously trained to refine the above features to improve accuracy
- Classifier is trained using cross entropy loss and the GAN is trained using a hybrid loss consisting of Adversarial loss, MSE loss, KL Divergence and the Classifier loss

Jan 2022 - present

Automatic Data Augmentation in Reinforcement Learning | Research Project

Guide: *Prof. Shivaram Kalyanakrishnan, Department of Computer Science and Engineering, IIT Bombay*

- Using data augmentations such as color jitter, rotation, cropping, grayscaling, etc to improve the performance of reinforcement learning agents on video games.
- Solve the POMDP using an Actor-Critic algorithm which in turn uses Proximal Policy Optimisation regularised with Elastic Net regularisation as well as Jensen-Shannon divergence to learn the optimal strategy.
- The data augmentations are chosen automatically during play time using an epsilon greedy strategy for the multi armed bandits

Professional Experience

May 2021 - July 2021

Software Development Engineering Intern | Amazon Development Centre, India

Received a Pre Placement Offer for exemplary performance

- Worked on the Create Rule and Get Rule APIs as part of the CRUD system which was to be integrated with the Amazon Cartographer 3.0 system
- Used various AWS services including AWS Lambda, DynamoDB and Product Selection as well as AWS tools such as Rapid Development Environment(RDE) and Bones CLI
- Used Breadth First Search and graph reversals to identify the redundant edge in the upsell service automatic code generation

May 2020 - July 2020

Research and Development Intern | Philips Innovations Campus, India

Received a Letter of Recommendation for exceptional work

- Prepared a technical report on the effect of using various types of Attention Networks on CNN architectures for improving classification accuracy
- Used the ImageNet Challenge Leaderboard Networks for improving the accuracy
- Annotated Images for Semantic Segmentation and performed it using HRNet-18 V2 along with gated attention units

Positions of Responsibility

Aug 2021 - Dec 2021

Associate Placement Coordinator

Placement Cell, IIT Bombay

- Part of a 20 member team which was responsible for the best ever placement season in college history, of 1800+ students from 18 departments in the institute
- Targeted 50+ new recruiters and managed the recruitment process of 20+ companies
- Coordinated with the PMs, DPCs, CCs and the InCs for the smooth conduction of the placement process in online mode

Aug 2020 - present

Teaching Assistant

Department of Mathematics & Department of AI & Data Science, IIT Bombay

- TA for the Machine Learning for Remote Sensing I & II courses which deal with neural networks, deep learning and computer vision
- Also the TA for the Differential Equations I & II courses which deal with solving and analysing various families of differential equations and their applications
- Helped the professors in the smooth conduction of the course and the course evaluation

Aug 2018 - present **Miscellaneous**

Other positions of responsibility

- Mentored 3 teams in Deep Learning projects as part of the Institute Technical Summer Project programme
- Mentored 2 teams in Neural Networks & Deep Learning as part of the Summer of Science
- Mentoring students for concepts in Physics as part of their JEE Mains and Advanced preparation at Arun Physics Academy

Other Relevant Projects

Aug 2021 - Nov 2021 **Low Light Noise Removal Using CNNs** | Research Project

Guide: *Prof. Amit Sethi, Department of Electrical Engineering, IIT Bombay*

- Studied and implemented the MIRNet architecture on the LOL dataset to restore high quality image content from a degraded version
- The architecture consists of recursive residual groups which in turn consist of several multi-scale residual blocks, selective kernel feature fusion and some dual attention units
- The model was trained using a hybrid loss consisting of the Charbonnier loss and L_1 + L_2 regularisation which was optimised using Adam with the ReduceLROnPlateau scheduler for the learning rate
- The new model outperformed the original MIRNet model in PSNR and SSIM metrics.

March 2020 - May 2020 **Nuclear Semantic Segmentation** | Summer Project

Guide: *Prof. Amit Sethi, Department of Electrical Engineering, IIT Bombay*

- Implemented a Mask-RCNN model with ResNet-50 backbone, a basic UNet model and an HRNet-18 model for Semantic Segmentation
- Final submission consisted of an HRNet-18 model with Gated Attention Networks
- Achieved, IoU of 0.601, F1 Score of 0.7591 and Aggregated Jaccard Index Score of 0.6732 on the test dataset of the competition, which was in the Top-10 of the leaderboard

March 2020 - May 2020 **Defense Against Adversarial Attacks** | Techfest Competition

Won the CoEP Techfest Competition, PredictX

- Team Leader of the team that won the CoEP techfest competition, PredictX
- Did a thorough study of FSGM, I-FSGM and PGD attack and their defence mechanisms
- Achieved over 95% Accuracy on each type of the attack with the help of a Single Model

Scholastic Achievements

2018-present Pursuing a minor in Computer Science and Engineering

2022 Ranked 4th in the Centre for Machine Intelligence and Data Science (CMInDS) department

2021 Achieved a perfect 10/10 SPI in the 7th semester

2022 Received Undergraduate Research Award (URA-01) for exceptional research work.

Extra-Curricular Activities

2020 Won Silver Medals in Singles & Doubles in the Electrical Department Badminton Open

2018-2019 Completed 80 Hours of Social Service under the Voice For Purpose Department as part of the National Social Service (NSS) Initiative of IIT Bombay

2007-2016 Represented school in various District Level Badminton and Chess Competitions