

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 9.03/10.0.
- 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%.

Scholastic Achievements

- 2018-present Pursuing a minor in Computer Science and Engineering
- 2022 Received Undergraduate Research Award (URA-01) for exceptional research work
- 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
- 2018 Secured all India rank 356 in JEE Advanced and 783 in JEE Mains

Professional Experience

- May 2021 - **Software Development Engineering Intern** | Amazon Development Centre, India
- July 2021 *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 integrated with the Amazon Cartographer 3.0 system
 - Incorporated 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 - **Research and Development Intern** | Philips Innovations Campus, India
- July 2020 *Received a Letter of Recommendation for exceptional work*
- Studied the effect of using various types of Attention Networks on CNN architectures for improving classification accuracy
 - Used the ImageNet Challenge Leaderboard Networks such as HRNet, PSPNet and ResNeXt for improving the accuracy.
 - Annotated Images for Semantic Segmentation and performed it using HRNet-18 V2 along with gated attention units

Publications

- January 2022 "RSINet: Inpainting Remotely Sensed Images Using Triple GAN Framework" A. Kumar, D. Tamboli, S. Pande, B. Banerjee - IEEE IGARSS 2022

Research Experience

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

July 2021 Guide: *Prof. Biplab Banerjee, Department of AI and Data Science, IIT Bombay*

- 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-MERGED & Open Cities AI datasets

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

present 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
- Work to be submitted to the **CVPR ECV 2022** workshop.

March 2022 - **Few Shot Class Incremental Learning** | Dual Degree Project

present Guide: *Prof. Zeynep Akata, Cluster of Excellence Machine Learning, University of Tubingen*

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

- Currently performing a literature review on few shot class incremental learning techniques.
- Trying out different methods such as class incremental domain adaptation which assumes a set of classes shared by all domains as well as making use of unlabelled data from a single domain which could act as a bridge in between different domains.

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

Nov 2021 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 - **Nuclear Semantic Segmentation** | Summer Project
 May 2020 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 - **Defense Against Adversarial Attacks** | Techfest Competition
 May 2020 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

Positions of Responsibility

- Aug 2021 - **Associate Placement Coordinator**
 Dec 2021 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 - **Teaching Assistant**
 present *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 - **Miscellaneous**
 present *Other positions of responsibility*
- Mentored 5 teams in Deep Learning projects as part of the Institute Technical Summer Project and Summer of Science programmes
 - Mentoring students for concepts in Physics as part of their JEE Mains and Advanced preparation at Arun Physics Academy

Extra-Curricular Activities

- 2020 Won Silver Medals in Singles & Doubles in the Electrical Department Badminton Open
- 2019-20 Represented Hostel 3 as part of the Badminton and Chess teams in the Inter-Hostel GC
- 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