

Viraj Bagal

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EDUCATION

Indian Institute of Science Education and Research

MS/MSc in Physics, Minor in Mathematics. GPA: 9.3/10

Pune, India

Aug. 2016 – June 2021

Willingdon College

Science. 85.85%

Sangli, India

Aug. 2014 – May 2016

EXPERIENCE

Artificial Intelligence Research Intern (NLP Project)

CCNSB Lab, IIT

May 2020 – Present

Hyderabad, India

- Implemented graph based models like vanilla GNNs, GCNs, GATs for molecular generation using Python, Pytorch and Geometric Pytorch.
- Trained large models using multi-GPU (parallel programming) DDP training on slurm using sbatch scripts, and Pytorch Lightning, and monitored them using wandb (W&B).
- Developed custom transformer decoder model similar to GPT that is 94% smaller and achieved new state-of-the-art results (increase in performance) on conditional molecular generation. Interpretability addressed using saliency maps.
- Implemented RNNs, LSTMs, VAEs, AAEs, GANs for performance comparison against our model. Plots created using matplotlib and seaborn.
- Shorter version of research paper accepted at AAAI-SDA 2021 workshop. Longer version under review at ACS Central Science. Virtually presented my work at AAAI 2021 (Conference H5-index: 126, Impact Score: 25.57). [Click here for the paper.](#)

Artificial Intelligence Research Intern (CV + NLP Project)

CVIT Lab, IIT

May 2020 – Present

Hyderabad, India

- Proposed and implemented a novel interpretable visual question answering (VQA) model on medical images, questions and answers.
- The model achieves new state-of-the-art performance with increase in accuracy and bleu score by 5% while being 66% more efficient than previous best models.
- Implemented self-supervised training with Masked Vision-Language Modeling and Image-Text Matching on multimodal BERT model using multi-GPU DDP training, HuggingFace, Pytorch Lightning, and monitored results using wandb (W&B).
- Implemented various CNN variants like ResNets, DenseNets, EfficientNets for image feature extraction and LSTMs, GRUs for text feature extraction.
- Research paper accepted at IEEE ISBI 2021 (Conference H5-index: 43, Impact Score: 6.6). [Click here for the paper.](#)

Physics & ML Research Intern

Particle Physics Lab, IISER

December 2019 – May 2020

Pune, India

- Worked on developing Convolutional Neural Networks for distinguishing fake electrons at the Large Hadron Collider, CERN
- Wrote C++ code for analysing different particle collision processes, grouping various particle collections and analysing their properties in ROOT software.
- Implemented end-to-end pipeline using Pytorch for faster experimentation of CNNs on the created dataset.
- Analysed results using probability histograms and ROC curves using sklearn, matplotlib and seaborn.
- The best model achieved 81% accuracy in identifying fake electrons.

PROJECTS

- Text Classification using Graph Neural Networks** February 2021 – February 2021
- Task was to predict the 'Industry tag' when given the description of the industry.
 - Done EDA using histograms, wordcloud, kdeplots and scatterplots after TSNE.
 - Created a weighted graph for each sample where I draw edge between words that co-occur and the weight is the frequency of co-occurrence.
 - Trained and compared Graph Convolution and Graph Attention networks with different poolings.
 - [Click here for the notebook.](#) [Click here for training and evaluation curves and comparison between models.](#)
- MNIST Model Deployment, Invoking Endpoint and Creating UI** January 2021 – January 2021
- Created S3 bucket, downloaded MNIST data and uploaded it to S3 bucket.
 - Trained a simple CNN model on that MNIST dataset using AWS Sagemaker Notebook Instance.
 - Deployed the trained model and made predictions using Sagemaker.
 - Exposed the local model to an endpoint using FastAPI.
 - Created simple UI using Streamlit.
- Wheat Head Object Detection** January 2021 – January 2021
- Implemented Stratified KFold based on the source of images and number of bounding boxes.
 - Trained Faster-RCNN with ResNet50 backbone and EfficientDet-B5, and compared their performance
 - Observed that EfficientDet-B5 has lesser number of training parameters, lesser training time per epoch but it scores better on public as well as private test sets than Faster-RCNN.
 - [Click here for code, qualitative and quantitative comparison.](#)
- Kaggle Competition: Prostate cANcer graDe Assessment (PANDA)** July 2020 – August 2020
- Task was to classify large whole slide images (WSIs) in 5 ISUP classes.
 - Trained single stage pipeline with various CNN variants like ResNets, Se-ResNets, DenseNets, EfficientNets and two stage pipeline for first getting ROIs using segmentation model like UNet followed by classification of ROIs.
 - Final model achieved 0.92 Kappa score on private test set and we secured 16th position (top 2%) on final leaderboard among 1010 participants across the globe.
- Efficient Resizing & Highly Imbalanced Multilabel Classification of Chest X-rays** June 2020 – July 2020
- Trained AutoEncoders for compressing large Chest X-rays to latent vectors.
 - Implemented ResNets and DenseNets on these latent vectors for multilabel classification.
 - Implemented Grad-CAM that highlights the decisive regions in the images.
 - [Click here for the code.](#) [Click here for the report.](#)
- Mixed Sample Data Augmentations (MSDAs)** May 2020 – June 2020
- Compared the performance of Baseline, Mixup, Cutmix and Fmix data augmentation on Fashion MNIST dataset. Coded in Pytorch and trained on Colab.
 - [Click here for the code.](#) [Click here to see my medium article on it.](#)

ACHIEVEMENTS

Secured All India Rank 69 in KVPY 2016
Secured All India Rank 2302 in JEE Advance 2016
National Top 1% in National Graduate Physics Examination 2019
2× Kaggle Expert. Only 8% of total Kaggle competitors are at this or above this rank
16th position (top 2%) in PANDA Competition on Kaggle among 1010 participants
Selected in Madhava Mathematics Competition conducted by Homi Bhabha Centre for Science Education, T.I.F.R
Two publications. One in [IEEE ISBI 2021](#) and the other in [AAAI-SDA 2021](#).

SKILLS

Languages: Python, C++, SQL
Frameworks: Pytorch, Pytorch Lightning, Keras, Tensorflow, FastAPI
Developer Tools: Amazon Sagemaker, Heroku, Streamlit, VS Code, Sublime
Libraries: OpenCV, Spacy, NLTK, Transformers, Sklearn, Pandas, NumPy, Scipy, Matplotlib, Seaborn, Huggingface
Worked On: Big Data, Fraud Detection, Healthcare using Machine Learning, Deep Learning, Computer Vision (Image Processing), Natural Language Processing (NLP)
Courses: Statistics, Probability, Data Science, Linear Algebra, Quantum and Statistical Mechanics
Soft Skills: Flexible and adaptable team player, good time management, good at working as an individual contributor as well.