Viraj Bagal

+91-7219652039 | virajbagal12@gmail.com | LinkedIn | GitHub | Personal Page

Publications

- Viraj Bagal et al., 'MMBERT: Multimodal BERT Pretraining for Improved Medical VQA', ISBI 2021.
- Minesh Mathew, Viraj Bagal et al., 'InfographicVQA', WACV 2022.
- Viraj Bagal et al., 'MolGPT: Molecular Generation using Transformer-Decoder Model', JCIM 2021.

Experience

AI Scientist April 2021 – Present

Synapsica Healthcare — YC W20 *Bangalore, India*

- Semantic segmentation of vertebral discs using axial MRI scans. Implemented Unet, Unet++, DeepLabV3. Managed to improve IOU score by using robust losses like Dice-TopK and generalization techniques like Stochastic Weighted Averaging.
- Coarse-grained localization of small body anomalies (Neural Foramina) in spine MRI scans using state-of-the-art detection algorithms like YOLOv3/v4/v5, FasterRCNN, etc.
- Fine grained multi-class classification of the localized anomalies.
- Managed to improve F1 score of the initial model from 0.66 to 0.81 by extensive data cleaning, focal loss, heavy augmentation and regularization.
- Managed to improve score by more than 3% using stochastic weighted averaging and self-distillation.
- Implemented active learning pipeline that significantly reduced the labelling cost.
- Worked on Keypoint detection in Spine X-rays. Used heatmap approaches for keypoint detection.

Deep Learning Research Intern May 2020 – April 2021

Generative NLP, CCNSB Lab, IIIT *Hyderabad, India*

- Worked on building models for scaffold and property conditioned molecule generation.
- Implemented graph based models like vanilla GNNs, GCNs, GATs for molecular generation using Python, Pytorch and Geometric Pytorch.
- 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 accepted in Journal of ChemInformatics (JCIM). Virtually presented my work at AAAI 2021 (Conference H5-index: 126, Impact Score: 25.57). Click here for the paper. Click here for repo.

Deep Learning Research Intern May 2020 – April 2021

Multimodal (CV + NLP) Understanding, CVIT Lab, IIIT *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 trainig, 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. Click here for repo.

Education

Indian Institute of Science Education and Research — Pune, India
MS/MSc in Physics, Minor in Mathematics. ***GPA: 9.3/10*** — *Aug. 2016 – June 2021*

Willingdon College — Sangli, India
Science. 85.85% — *Aug. 2014 – May 2016*

Projects

Multi-Object Tracking Of People — July 2021

- Tested two MOT algorithms: Yolov5 + DeepSORT and FairMOT, on MOT16 dataset.
- Yolov5 + DeepSORT achieved 52% MOTA on MOT16.
- FairMOT achieved 73% MOTA.
- For implementation details, qualitative and quantitative results, click here. For Weights and Biases report, click here.

Ecommerce Product Matching — April 2021 – May 2021

- Given image and textual description of different products, the task was to match similar products with each other.
- Since test set had mostly unseen products, I implemented semi-supervised approach.
- Used different efficientnet series for image feature extraction. BERT for text feature extraction. Multimodal BERT for joint feature extraction.
- Implemented ArcMargin head for reducing distance between intra-class samples and increasing distance between inter-class samples.
- Implemented NearestNeighbors algorithm on the extracted features.
- Click here for the code.

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-occurence.
- 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.

Image Translation using CycleGAN — January 2021 – January 2021

- Implemented CycleGAN for translating photos to Monet paintings and Monet paintings to photos.
- Improved the performance by implementing One sided label smoothing and Two-time Scale Update.
- Click here for code and results.

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
- 16^{th} 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.
- Three publications. One in IEEE ISBI 2021, one in WACV 2022 and one in Journal of ChemInformatics (JCIM).