Viraj Bagal

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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*

- Experienced in working on problems like multi-class multi-label classification, object detection, semantic segmentation, keypoint detection, ranking, text format conversions, text tone conversion
- Trained and productionized models like **Transformers, Efficientnets, Yolo, Faster RCNNs, Unets**
- Improved F1 score of the initial classification model by **23%** by extensive data cleaning, regularization and by more than **3%** using generalization techniques like SWA and self-distillation.
- Implemented active learning pipeline that significantly reduced the labelling cost.
- Converted a regression problem into keypoint detection in Spine X-rays using heatmaps. Resulted in >**100%** improvement in prediction acceptance compared to previous model.
- Implemented batch processing instead of sequential processing and ONNX runtime accelerator in production pipeline. This resulted in **30%** and **65%** reduction in production pipeline runtime respectively.
- Made the product interactive that can allow user based changes in the AI predictions with responses in the order of **1 millisecond**.
- Instruction finetuned open sourced LLMs like **Dolly, Falcon** for tone changes and conversion of medical text in different formats

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.
- Modified **LayoutLM** model to perform VQA on infographics instead of documents. Click here for paper

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*

Projects

AI based Content Insights April 2023

- Developed **LLM** based content insight product that can summarize and allow Q&A on any CSV, PDF, Doc, Image, Youtube video.
- Performed **prompt engineering** for **ChatGPT and GPT-4 APIs**.
- Used **OpenAI embeddings** for creating embeddings of the content. Used **Activeloop Deeplake** as the vector database and **retrieval augmented generation** for Q&A. Used **langchain** to perform all this.
- Coded many APIs for file-transfer, processing, etc. using **FastAPI**. Coded frontend using **Streamlit**
- Deployed on **AWS EC2** instance using docker compose and traefik for reverse proxy. Click here for product
- Click here for the code

MLOps Jan 2023

- Image classification app where the result is stored in mongodb and the image is stored in MinIO.
- MlFlow is used to load model in production stage. MlFlow server has postgresDB as backend store and MinIO as the artifact path. Project GitHub Link

MLOps October 2021

- Model monitoring using Weights and Biases, and Training configuration setup using Hydra.
- Data Version Control using DVC and Model Packaging using Fast API + ONNX + Docker.
- CI/CD using GitHub Actions, and created Container Registry using AWS ECR.
- Serverless Deployment using AWS Lambda and Prediction Monitoring using Elasticsearch Cluster + Kibana.

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

Skills

- Technical: Machine Learning, Deep Learning, Computer Vision, Natural Language Processing, Python, Pytorch, TensorFlow, NLTK, Spacy, CoreNLP, PySpark, SQL, Docker, AWS EC2, AWS ECR, AWS Lambda, Git, DVC, ONNX, API Gateway, AWS ElasticSearch, CI/CD, MLOps, FastAPI, Prompt Engineering, MongoDB, LangChain, Transformers, Diffusers, Accelerate, Optimum
- Non-Technical: Good at communicating technical aspects in simpler manner. Good at technical writing. Have experience in managing a team of 2 people at the current company.
- Open Source Contribution: Made contributions to Albumentations library (widely used in COmputer Vision) and Pytorch Lightning.