Vinayak Prem Bhatia

Email: vinayak.bhatia22@spit.ac.in | vvinayakkk | **Mobile:** +91 9930679651 | Vinayak-Bhatia

Education

- **SP Jain Institute of Management & Research** — Mumbai, India
  Minors in Management — *Feb. 2024 - Present*
- **Sardar Patel Institute of Technology** — Mumbai, India
  B.Tech in CSE with Specialization in AI-ML; CGPA: 9.34 — *Nov. 2022 - Present*

Research Experience

- **Research Assistant under Prof. Vaishnavee Rathod** — Mumbai, India
  Enhanced Image Processing for Vehicle and Crack Detection — *July 2024 - Present*
  - Developed a high-performance **Vehicle Detection** model using **Vision Transformer (ViT)**, achieving 92.8% accuracy on 16,185 images. Fine-tuned hyperparameters to optimize detection speed and accuracy, supporting real-time applications.
  - Implemented an advanced **Crack Detection** system leveraging **YOLOv9** and ViT. Designed custom preprocessing pipelines to reduce false positives, improving precision and robustness for structural safety assessments.
- **Sardar Patel Institute of Technology** — Mumbai, India
  Gen-AI Intern — *August 2024 - Present*
  - Fine-tuned six advanced **Large Language Models** (**Gemini 2B**, **Gemini 7B**, **LLaMA 2**, **LLaMA 3**, **Falcon 7B**, **Flan-T5**) and evaluated model performance using **ROUGE**, **BERT Score**, and **BLEU Score** to select the best-performing model for an interview chatbot.
  - Developed a **robust AI pipeline** incorporating **dynamic difficulty adjustment**, **real-time performance tracking**, and **personalized feedback** to enhance user engagement, **topic coverage**, and **answer validation** in simulated interview scenarios.

Projects

- **Ongoing: Advanced Vehicle Detection and Tracking System**
  - Developing a vehicle detection and tracking system for video surveillance using **YOLO versions 8 to 11**, achieving high detection accuracy and comparing performance metrics such as **precision, recall**, and **mAP**. Implemented tracking with **DeepSORT, ByteTrack, and FairMOT** to enhance tracking accuracy and robustness. Integrated **geo-registration** with GPS data for real-world frame alignment. Estimated traffic parameters like **speed, density**, and flow, and conducted vehicle classification, analyzing **classification metrics** to address challenges like occlusions.
- **Advanced Image Segmentation Models**
  - **Road and Building Segmentation using EffUNet:** Designed and implemented a semantic segmentation model combining **EfficientNetV2** as the encoder and **UNet** as the decoder. Preprocessed high-resolution aerial imagery datasets using techniques like data augmentation and normalization to enhance model generalizability. Achieved a mean IoU of 0.8365 for buildings and 0.9153 for roads through extensive hyperparameter tuning and loss function optimization (**Dice Loss + BCE**)
  - **UNet for Cell Nuclei Segmentation:** Developed a **UNet**-based biomedical segmentation model for cell nuclei identification in microscopic images. Leveraged **skip connections** to retain spatial information, enhancing segmentation accuracy. Applied advanced preprocessing techniques, including contrast enhancement, to handle noise and variations in the dataset.
- **AI and Vision-Based Models**
  - **Qwen2VL Image-Based OCR Query System**: Developed a local image-to-text query system using the **Qwen2VL** model, capable of answering detailed questions about images. Successfully optimized it to run on a system with 16GB RAM.
  - **Gesture Recognition System**: Developed a MediaPipe-based system to detect hand poses, signs, and gestures using a lightweight **MLP**, with TFLite models, custom datasets, and Jupyter notebooks for training and evaluation.
  - **Brain Tumor Detection with ResNet-50:**: Implemented a ResNet-50-based CNN for classifying MRI images into tumor types. Performed data preprocessing, model training with categorical crossentropy and Adam optimizer, and conducted evaluations using Grad-CAM visualization, ROC curves, and a confusion matrix.

Technical Skills

- **Areas of Interest:** Machine Learning, Deep Learning, NLP, Computer Vision, Generative AI
- **Frameworks and Database:** TensorFlow, Scikit-Learn, Django, MySQL, MongoDB, PostgreSQL
- **Programming Languages:** Python (NumPy, Pandas, SpaCy, Keras, NLTK, OpenCV), C, C++, HTML, CSS

Achievements

- **Achieved 1st Place at IIIT Nagpur Genathon 2.0 (National Level)** for innovative solutions using advanced technologies.
- **Achieved World Rank 6 in Zelestra X AWS ML Ascend Challenge**
- **Secured All-India Rank 201 in Amazon ML Challenge Hackathon (National Level)**.
- **Shortlisted for Finals of Smart India Hackathon** amongst the top 5 teams for Alumni Connect Problem Statement.
- **Secured 3rd Position at Wall Street Analytics Challenge '24** by BITS Pilani Hyderabad.
- **Ranked 6th in VCET Hackathon** by building "Student-Mentee Connect" using text-to-SQL, RAG, and Django.
- **Achieved Top 28 in M# Manipal Hackathon (National Level)** with optimized real-world problem-solving strategies.

Certificates

- Machine Learning A-Z | ***Udemy***
- Artificial Intelligence A-Z | ***Udemy***