# Vishal Purohit

2550 Yeager Rd., West Lafayette, Indiana | +1-(765)-775-7589 | purohitv@purdue.edu | www.linkedin.com/in/vishalsp

## SKILLS

- **Programming Languages & Frameworks:** Python (5 years), PyTorch (3 years), TensorFlow (2+ years).
- **ML Skills:** Diffusion Models, GANs, Large Language Models, Transformers, Object detection & Segmentation, Meta-Learning, NeRF, Distributed training on TPUs and GPUs.

## EDUCATION

**Purdue University** — **West Lafayette, Indiana**

- ***Ph.D. in Electrical and Computer Engineering*** — **August 2021- Present**
  Concentration: Deep Learning & Computer Vision
  - Awarded a research assistantship from Google, USA to conduct research on reproducibility of universal image segmentation models. Supervised by Dr. Abdullah Rashawn (Google) & Prof. James Davis (Purdue).
  - Received outstanding graduate mentor award for mentoring research projects in Deep Learning and Computer Vision.

**KLS Gogte Institute of Technology** — **Karnataka, India**
***Bachelor of Engineering in Electronics and Communication*** — **June 2018**

## RESEARCH / WORK EXPERIENCE

**Google Special Projects x Purdue** — **West Lafayette, Indiana**
***Research Assistant – TensorFlow and PyTorch*** — **January 2023 – Present**

- Spearheading the development, validation, and performance verification of production-ready reproducible implementations of universal semantic segmentation models - MaskFormer and Mask2Former. Code accepted to Google public repo MaskFormer & Mask2Former. Hands on experience with code profiling and performance optimization of models on TPUs and GPUs.
- Carrying out independent research on Large Language Models (LLMs) with a focus on few shot tasks via various prompting techniques.

**Indian Institute of Technology (IIT)** — **Varanasi, India**
***Research Intern – Meta learning and Federated Learning*** — **October 2020 – August 2021**

- Conceptualized and developed meta-learning-based algorithm for classification task in medical domain for datasets with the long-tail distribution. Authored paper and published in Pattern Recognition journal.
- Led & developed federated knowledge distillation techniques using deep model inversion for privacy preserved COVID19 chest x-ray image classification. Coauthored a paper in IEEE Transactions in Industrial Informatics.
- Designed and developed a semi-self-supervised learning framework using contrastive learning and formulated an effective combination of loss functions for learning with partially labeled datasets. Authored a paper in IEEE Transactions in Industrial Informatics.

**Mobiquest Solutions** — **Remote**
***Machine Learning Software Engineer – TensorFlowJS, JavaScript and Python*** — **June 2020 – October 2020**

- Led the deployment of Object detection models using TensorFlow JS and developed a website using JavaScript for real-time monitoring. Collaborated and brainstormed ideas with the cofounder for rapid prototyping of deep learning-based solutions.

**Tata Elxsi** — **Pune, India**
***Engineer – OpenCV, TensorRT, C++, Optics*** — **September 2018 – May 2020**

- Responsible for development, deployment, and model validation of object detection models - Faster RCNN for bacteria colony enumeration. Optimized inference pipeline of vision models time by 0.5 seconds and reduced memory footprint of the model by 30% using techniques like quantization on Nvidia Jetson platform.
- Designed & shipped scalable and production-quality algorithms for optical system calibration with improvement in performance by 50% for MTF calculation, chromatic aberration detection, and spatial distortion. Successfully shipped multiple image processing algorithms in C++. Led development of customer-facing desktop application for predictive model validation, deployment, implementation and support continuous training and model updates. Solely responsible for increasing project revenue by $100k.

## PUBLICATIONS

- **V. Purohit**, J. Luo, Y. Chi, Q. Guo, S. Chan, Q. Qiu "Multi-Exposure Synthesis for One-Bit Quanta Image Colorization" **(Under Submission to CVPR 2024)**
- **V. Purohit**, Z. Wang, Q. Qiu "Denoise-Merge-Denoise: Improving Zero-Shot Performance on Inverse Problems using Denoising Diffusion Models" **(Under Submission to CVPR 2024)**
- V. Bharti, A. Kumar, **V. Purohit**, A. Singh, SK Singh "A Label Efficient Semi Self-Supervised Learning Framework for IoT Devices in Industrial Process"- IEEE Transactions on Industrial Informatics, 2023
- A. Kumar*, **V. Purohit***, V. Bharti, R. Singh, SK Singh "MediSecFed: Private and Secure Medical Image Classification in the Presence of Malicious Clients" - IEEE Transactions on Industrial Informatics, 2021
- R. Singh, V. Bharti, **V. Purohit**, AK Singh, SK Singh "MetaMed: Few-Shot medical image classification using gradient based meta-learning" - Pattern Recognition, 2021, Elsevier

## PROJECTS

- **"Careful or Crafty? The Mixed Bag of Synthetic Prompts! –** *LLMs, Prompting, PyTorch*
  We leveraged the recent finding about an important component of a demonstration to synthesize prompts for LLM specifically for Chain-of-Thought Prompting and Program Aided Prompting. Imposed consistent demonstration generation using generative power of LLMs and self-correction steps.
  Further, we leveraged the joint embedding space of seed prompts and synthetic prompt for ranking task.
- **Zero-Shot Diffusion Chain Mixing for solving Inverse Problems –** *Diffusion models, PyTorch*
  Solved linear inverse problems using DDPM model in zero-shot manner by leveraging the range-null space decomposition across multiple parallel diffusion chains to impose cross-consistency conditions. Further, proposed a *guidance term* to improve the image fidelity under very sparse measurements and achieved 3dB better PSNR than current state-of-the art zero-shot method.

- **Exposure synthesis for One-Bit QIS Image –** *GANs, NeuralODEs*
  Worked on exposure adaptive image generation framework based on GAN to generate a set of exposure bracketed images from single binary image (overexposed or underexposed). Leveraged NeuralODE and imposed continuity of convolutional filter parameters to synthesize model parameters. Outperformed existing solutions by a minimum of 4 FID score points.
- **Ortho-ODE: Enhancing Robustness and of Neural ODEs against Adversarial Attacks**
  Worked on imposing orthogonality constraints on the model parameters that parameterize the ODE to defend against adversarial attacks on classification tasks. Leveraged cayley transform to impose the orthogonality constraints on the filter parameters.

## RELATED COURSE WORK

- Linear Algebra, Optimization for Deep Learning, Deep Learning, Computer Vision, Advanced Topics in Reasoning with LLMs, Machine Learning Theory, Artificial Intelligence

## RESEARCH TALKS

- Research presentation on topic of "1-bit Image Coloring" to Dr. Mark Shaw, a Distinguished Technologist and Strategist at HP.

## HONORS, LEADERSHIP ACTIVITIES & AFFILIATIONS

- Research Assistantship from Google, USA for reproducibility, research supported by TPU cloud research program.
- "Outstanding graduate mentor" award and "Share with the world" award - Purdue University, 2022
- Leading open-source efforts for reproducibility in deep learning at Purdue University and supervised a team of 20+ undergrads.
- Reviewer - CVPRW 2022, IEEE International Conference on Multimedia & Expo (ICME) 2023, ICMEW 2023, ICML 2023, NeurIPS 2023, ICLR 2024
- Mentored team of 20+ undergrads for the 2022 IEEE Autonomous Unmanned Aerial Vehicles (UAV) Chase Challenge organized at Purdue UAS Research and Test Facility (PURT), funded by the NSF and sponsored by the IEEE.