

Vatsa S. Patel

Email: patelvatsa09@gmail.com | Phone no.: +1 (937) 838 9654

LinkedIn: www.linkedin.com/in/vatsa-patel | Website: www.vatsapatel.com

SUMMARY

Education: Ph.D. in Computer Science specializing in artificial intelligence, machine learning, and computational technologies.

Experience: Research and Professional experience in computer vision, and real-world machine learning applications.

Skills: Proficient in Python, PyTorch, TensorFlow, OpenCV, and ML techniques for designing and deploying robust models.

Soft Skills: Creative thinker, adaptable to independent or team-based work, with strong time management skills.

TECHNICAL PROFICIENCIES

Programming languages: Python, Java, MATLAB, C++, R, JavaScript, HTML5, CSS3

Machine Learning & Deep Learning: PyTorch, TensorFlow, Keras, Scikit-learn, Autoencoders, Transformers (BERT, GPT), BNNs, Multi-modal modeling, Hugging Face, Qiskit

Data Analytics & Visualization: Tableau, TensorBoard, Matplotlib, Pandas, NumPy, Excel, PowerBI

Image & Signal Processing: OpenCV, Pillow, SciPy, Image Processing Frameworks, Image Augmentation, Object Detection, Convolutional Neural Networks, Feature Engineering, Image Segmentation, Signal Denoising, Librosa

Software Development Tools & DevOps: Visual Studio, Docker, Open API, GCP, Gradio, PyQt, Streamlit, Tkinter, Simulink

Database & Web Development: MySQL, MongoDB, Flask, Express, React

EXPERIENCES

Assistant Professor of Computer Science

Penn State Harrisburg, Middletown, PA

August 2025 – Present

- Teach and mentor undergraduate and graduate students in AI, machine learning, and data structures, fostering hands-on, research-driven learning.
- Lead research projects in computer vision, generative AI, and multimodal learning, contributing to publications and collaborative initiatives.
- Support the academic mission through grant writing, curriculum development, and student supervision, advancing departmental growth and innovation.

Machine Learning Associate

University of Dayton Research Institute (UDRI), Dayton, OH

January 2025 – July 2025

- Developed a data generation tool for software-defined radio (SDR) transmitters and receivers by integrating AI-based signal processing, enabling realistic simulations and improving testing accuracy for communication systems.
- Engineered and monitored various machine learning models, including multi-model fusion architectures and online learning techniques, to enhance prediction accuracy and system adaptability across dynamic and evolving datasets.
- Designed a modular signal processing pipeline with real-time ML inference and visualization, and formulated interactive interfaces using Streamlit, reducing manual overhead and enhancing usability across AI workflows.

Research Intern

University of Dayton Research Institute (UDRI), Dayton, OH

May 2024 – August 2024

- Led development of signal processing models, achieving a 10% improvement in accuracy and reduced noise interference.
- Designed and optimized probabilistic models (Bayesian neural networks) for signal extraction, integrated with quantum machine learning (QML) frameworks, enhancing denoising performance.
- Delivered 100% on time, within-budget project completion using Python, MATLAB, and Qiskit, ensuring efficient development and meeting all project requirements.

Computer Vision Engineer

NSFI-Corp Funded Research, University of Dayton

May 2023 – August 2023

- Implemented YOLOv5 for real-time vehicle detection, processing over 244,000 vehicles across 26,000 video frames with high precision and throughput. This system significantly improved the detection accuracy and reduced latency, ensuring efficient monitoring in dynamic traffic environments.
- Optimized object detection models for real-time traffic monitoring using a hyperplane-based approach to count vehicles, enhancing detection speed and accuracy for data-driven urban planning.
- Built a robust data pipeline for integrating video data with city traffic simulators, informing urban planning and infrastructure decisions, preventing potential construction flaws.

Research Assistant

University of Dayton

February 2022 – August 2022

- Simulated adverse weather conditions (fog, rain, snow) by generating a dataset of 9,700 images using Imgaug, Albumentations, and Gaussian blur to evaluate the robustness of object detection models in real-world traffic scenarios.
- Conducted a comprehensive evaluation of YOLO-based models, including YOLOv5x, demonstrating improved resilience and accuracy under extreme weather conditions.
- Delivered actionable insights to enhance object detection systems for traffic monitoring, improving reliability and performance in adverse environments.

Machine Learning Researcher

Silfex, Inc. – Division of Lam Research, in collaboration with University of Dayton

October 2020 – July 2021

- Constructed motion frame detection algorithms using CNNs and OpenCV to identify machine failures during 7 stages of Czochralski silicon growth, achieving 80% accuracy.
- Trained and compared TCN, CNN, and SVM models using Python (OpenCV, Matplotlib, Keras) to evaluate effectiveness across failure detection tasks.
- Automated real-time failure detection in CCTV feeds, reducing manual monitoring by over 168 hours and boosting operational efficiency.

Graduate Assistant

Vision & Mixed Reality Lab, University of Dayton

August 2021 – December 2024

Large Language Model – Based Text Generation and Analysis

- Configured a custom GPT-2 model for generative AI and NLP tasks using Hugging Face Transformers and PyTorch, improving text diversity and coherence via advanced sampling strategies.
- Formed a user-friendly interface using Gradio, enabling real-time interaction for dynamic, context-aware text generation based on user inputs.
- Optimized model performance and coherence by fine-tuning hyperparameters, achieving a 15% improvement in BLEU and ROUGE scores compared to the default configuration.

Image De-Photobombing Benchmarking

- Compiled and annotated 300 photobombed images, De-Photobombing dataset (DPD 300), using MATLAB to create logical masks and ground truth data.
- Applied and investigated various inpainting methods, including Exemplar-Based, Coherence Transport, Fast Marching, Fluid Dynamics, Gated Convolution, and Fourier Convolution-based techniques.
- Analyzed and validated outcomes using different metrics like FID, SSIM and PSNR to assess the effectiveness of each inpainting method.

GAIA: Generative Artificial Image Assessment for Text-to-Image Model Evaluation

- Developed GAIA, a novel dataset comprising 800 images from 8 generative AI models, evaluated using user rankings for criteria like realism, aesthetics, visual quality, and prompt similarity.
- Integrated visual and textual features for analysis using deep learning models (VGG16, Word2Vec) and regression techniques, providing a benchmark for evaluating text-to-image synthesis performance.
- Conducted prompt complexity analysis, categorizing 100 prompts into simple and complex sets, offering insights into generative AI's ability to handle diverse scenarios and advancing multimodal learning approaches.

Real Estate Pricing Prediction Via Textual and Visual Features

- Adopted multimodal methodologies focusing on integrating visual cues and estate attributes for real estate price prediction.
- Managed a dataset of 3,000 houses across 74 U.S. cities, annotating 14 estate attributes and five images per house.
- Utilized CNNs to extract image features, combined with estate attributes, achieving a Mean Absolute Error (MAE) of 16.60 using a multi-kernel deep learning regression model.

EDUCATIONS

Doctor of Philosophy, Computer Science

University of Dayton, Dayton, OH, USA

August 2021 – Dec 2024, GPA: 3.8/4

Master of Science, Computer Science

University of Dayton, Dayton, OH, USA

August 2019 – May 2021, GPA: 3.9/4

PUBLICATIONS

I have **10+ peer-reviewed publications** in leading journals and conferences, demonstrating expertise in areas such as AI, machine learning and computer vision. For a full list of my publications, please visit my [webpage](#) or my [google scholar](#) profile.