+1(548)333-3485
Waterloo, Ontario
khannaaiig@gmail.com

DHEERAJ KHANNA

Portfolio: dkhanna511.github.io
Github: dkhanna511
Linkedin: dheeraj-khanna-05

Education

MASc in Systems Design Engineering, *University of Waterloo, Canada* **Sep 2022 — Feb 2025**
B.Tech in Electronics and Communication, *Guru Gobind Singh Indraprastha University, India* **Aug 2016 — Sep 2020**

Skills

Languages & Platforms	Python, C++, C, ROS, Linux, Git, Bitbucket, Docker, SSH
Frameworks & Libraries	PyTorch, LibTorch, TensorFlow, Keras, ONNX, Scikit-learn, NumPy, Pandas, OpenCV, Pillow, Tkinter, Plotly, Seaborn, Matplotlib, Flask, Weights & Biases
Technologies	Computer Vision, Deep Learning, Machine Learning, Data Analysis, Sequence Models
Hardware	VLP-16 LiDAR, FLIR Pointgrey Cameras, Raspberry Pi 3B, Arduino, ATmega 2560, NVIDIA Jetson

Work Experience

Graduate Student Researcher | **VIP Lab, University of Waterloo ; ATS Automation** | *Supervisor: Prof. John Zelek* **Jan 2023 — Feb 2025**
- Designed and implemented a novel prediction model integrating Mamba sequence model and self-attention mechanisms with advanced data association strategies for real-time multi-object tracking, achieving state-of-the-art performance on complex motion scenarios.
- Created a novel automatic bounding box annotation pipeline to annotate any video with multiple objects using Point Tracking, Segment Anything (SAM), and Yolo-v8, achieving the annotation speed of 10 FPS. (*View Paper*)
- Developed a proprietary algorithm using multi-object tracking to estimate the velocities of hundreds of small assembly parts in a high throughput industrial environment, improving production efficiency and reducing manual intervention.

Computer Vision Research Engineer | **LENS Corporation, India** **Feb 2022 — May 2022**
- Migrated a latent fingerprint extraction and matching pipeline from Python to C++ using Libtorch to enable faster GPU and CPU-based deployment, optimizing performance and reducing latency.
- Programmed custom signal processing functions, including Fourier Transforms and Gabor Filtering, in C++ from scratch to process fingerprint data, overcoming constraints in existing matrix and signal processing C++ libraries.

Perception Research Engineer | **Autonomous Vehicle Project, IIIT Delhi, India** | *Supervisor: Dr. Saket Anand* **Oct 2020 — Feb 2022**
- Executed the design and deployment of a sensor fusion system for an autonomous vehicle, integrating 2 front-facing cameras and a LiDAR, enhancing sensor fusion accuracy and real-time detection.
- Optimized real-time lane detection and tracking for self-driving vehicle using Torchscript and C++ and integrating them with ROS, ensuring 12+ FPS processing speed on an NVIDIA Jetson Nano.

Research Intern | **Microsoft Research India** | *Supervisor: Dr. Akshay Nambi* **Feb 2020 — Sep 2020**
- Redesigned and scaled the Automated Driver License Testing (ALT) project for various Regional Transport Offices (RTO) across India. The scaling led to the deployment of the project in 10+ cities in India with 99% accuracy in automated driving test results. (*View Project*)

Projects

Image Enhancement and Object Detection in Rainy Weather Conditions | *Deep Learning, GANs, PyTorch* **Jan 2023 — Apr 2023**
- Implemented a GAN-based neural network for rain image denoising, integrating Circular Hough Transforms and optimizing the loss function with Perceptual Loss (LPIPS) and Structural Similarity (SSIM), boosting Peak Signal-to-Noise Ratio (PSNR) by 5.8%.

Multi-sensor Calibration for Autonomous vehicle | *Photogrammetry, ROS, Sensors* **Oct 2020 — Feb 2022**
- Developed an automated pipeline for calibrating multiple VLP-16 LiDARs and FLIR Pointgrey cameras using a single checkerboard, minimizing human intervention. Used ROS for data acquisition and applied RANSAC and DBSCAN for point cloud filtering.
- Utilized Linear Algebra, 3D View Geometry, and Statistical ML to refine multi-sensor pose estimates, inferencing the sensor fusion with C++ and Torchscript on the autonomous car.

RecipeDB | *Pandas, Data Visualizations* (*View Project*) **Jun 2019 — Sep 2019**
- Curated, integrated, and compiled databases of recipes from various online sources using web scraping and Pandas.
- Performed thorough multi-level analysis of the recipe data of over 22 regions based on dietary classification, ingredient composition, and nutrition profiles. Managed features, statistical designs, and visualizations using Pandas, Matplotlib, Plotly, and Seaborn.

Harvestor Bot | **E-Yantra Robotics competition** | *Image Processing, Embedded Systems* (*View Project*) **Nov 2017 — Feb 2018**
- Secured an all-India 6th rank by developing innovative path planning algorithms in Embedded C for a Firebird V robot equipped with a 3-DOF robotic arm, enabling it to efficiently navigate a grid, identify, collect, and deposit various types of fruits.
- Applied morphological techniques in OpenCV to accurately identify fruits from a USB camera feed, achieving 100% accuracy in test cases.

Publications

- **POPCat: Propagation of Particles for Complex Annotation Tasks**, Conference on Robots and Vision (CRV), 2024. (*View paper*)
- **Recipedb: A resource for exploring recipes**,Database Journal (Oxford), pp. baaa077, Nov 2020. (*View Paper*)
- **NTIRE 2019 Challenge on Video Super-Resolution:Methods and Results**, Co-author of team paper, IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW-2019). (*View paper*)