Abhi Kamboj

PhD Candidate | ***NSF Graduate Research Fellow*** | Sensing and AI
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ACADEMIC PROFILE

University of Illinois at Urbana-Champaign (UIUC) **May 2026**

Doctor of Philosophy in Electrical and Computer Engineering *GPA 3.6/4.0*

Bachelor of Science in Computer Engineering, Dual in Engineering Entrepreneurship (May 2021) *GPA: 3.9/4.0*

Academic Exchange Semester School of Computer and Communication Sciences EPFL, Switzerland (May 2019)

PUBLICATIONS AND PRESENTATIONS

(**Oral, IJCAI 2025**) Nguyen, A., Kamboj, A. & Do, M. (2025). Robult: Leveraging Redundancy and Modality-Specific Features for Robust Multimodal Learning. Proceedings of the 34th International Joint Conference on Artificial Intelligence (IJCAI), Montreal.

(**CVPR 2025, VisCon: Workshop on Visual Concepts**) Kamboj, A., Nguyen, A. & Do, M. (2024). Towards Achieving Perfect Multimodal Alignment. arXiv preprint: 2503.15352

(**Neurips 2024, UniReps: Workshop on Unifying Representations**) Kamboj, A., Nguyen, A. & Do, M. (2024). C3T: Cross-Modal Transfer Through Time for Human Action Recognition. arXiv preprint: 2407.16803

(**MS Thesis, Publication Pending**) Kamboj, A., & Do, M. (2024). A Survey of IMU Based Cross-Modal Transfer Learning in Human Activity Recognition. arXiv preprint arXiv:2403.15444.

(**Poster, 3rd Place Award**) Kamboj, A., Do, M. (2024, April). Sensor Fusion and Cross-Modal Transfer in Human Action Recognition. In 7th Illinois and Health Summit - Healthy Aging of Brain and Mind with AI.

(**Arxiv**) Kamboj, A. (2023). A Brief Survey on Leveraging Large Scale Vision Models for Enhanced Robot Grasping. arXiv preprint arXiv:2406.11786.

(**Oral, RO-MAN**) Kamboj, A., Ji, T., & Driggs-Campbell, K. (2022, August). Examining Audio Communication Mechanisms for Supervising Fleets of Agricultural Robots. In *2022 31st IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)* (pp. 293-300). IEEE.

(**Arxiv**) Kamboj, A. (2022). The Progression of Transformers from Language to Vision to MOT: A Literature Review on Multi-Object Tracking with Transformers. arXiv preprint arXiv:2406.16784

(**Senior Thesis**) Kamboj, A. (2021, May). The Optimal Audio Interface for Teleoperation on an Autonomous Farm. *Illinois Digital Environment for Access to Learning: Senior Theses - Electrical and Computer Engineering*.

RESEARCH EXPERIENCE

Google PhD SWE Internship, Mountain View, CA **May 2025 – Aug 2025**

- Pioneered a high-impact research project on the AdsAI team to develop agentic AGI models for temporal reasoning in complex videos, achieving a 2.6% boost on the Minerva dataset – 10% closer to human performance
- Explored tool-usage and long-video based Retrieval Augmented Generation (RAG) for multi-agent multi-modal generative vision language models (VLMs) motivated by detailed ablations and analyses on 30+ failure cases

Computational Imaging Group, Multi-modal Deep Learning Research, UIUC **Aug 2022 – May 2025**

- Examined advanced techniques (e.g., self-attention, contrastive alignment) for temporal robustness in multi-modal learning and computer vision to enhance human motion analysis under guidance of Dr. Minh Do

Machine Learning Research Intern at Netradyne, San Deigo, CA **May 2022 - Aug 2022, May 2023 - Aug 2023**

- Trained natural language processing-like GPT models on time-series driving data for pattern recognition-based behavior prediction, forming a physics informed large language model (LLM) via unsupervised learning
- Devised a novel transformer-based neural network for multi-object tracking (MOT), improving performance on MOT17 by encoding temporal windows of frames and jointly extracting detections and tracks in PyTorch

Human Centered Autonomy Lab, UIUC **Aug 2020 – Dec 2022**

- Studied manipulator pose estimation using foundation model pretraining under Dr. Katie Driggs-Campbell
- Created multiagent grid-world simulations and explored effective robot speech interaction via a user study

Sensor Fusion in Machine Learning Research, UIUC **Jan 2022 – Dec 2022**

- Studied AI on smart home IoT for human analysis using foundation model pretraining under Dr. Deming Chen
- Investigated methods to fuse radar, lidar, and camera data for autonomous driving perception in fog/rain

Embedded AI Intern at NVIDIA, Santa Clara, CA **May 2021 - Sep 2021**

- Surveyed and implemented state-of-the-art (SoTA) scene text recognition (STR) models on a Jetson AGX Xavier
- Optimized SoTA STR models using TensorRT and benchmarked the throughput and latency on edge AI devices
- Published on NVIDIA-AI-IOT/scene-text-recognition Github and on NVIDIA's Jetson AI Labs Youtube (3k views)

Machine Learning Building Classification, EPFL **Oct 2019 – Dec 2019**

- Developed a supervised building classification system in python for a civil engineering lab by identifying the buildings' window to facade ratio with a Torchvision CNN and using images from the Google Streetview API
- Determined the optimal number of images needed to classify buildings on various ResNet CNNs

NSF REU in Robotics Sensor Networks Lab, University of Minnesota-Twin Cities **May 2018 - Aug 2018**

- Researched intelligent robot navigation, reinforcement learning, and obstacle avoidance with Dr. Volkan Isler
- Developed an autonomous indoor navigation system for a Create2 iRobot with a 2D Hokuyo laser using SLAM
- Implemented navigation algorithms, e.g. random trajectory generation, A* Search, Kalman Filter, Q-learning

Graphics and Visualization Lab, University of Minnesota-Twin Cities **Aug 2016 - May 2017**

- Built a system enabling the use of a subject's bare hands in virtual reality (VR) with an Oculus Rift, a Leap Motion sensor, and UnrealEngine4, and conducted a 7-point Likert scale user study on haptics' effect on ownership and agency over the avatar in VR; received the Scholar's of Distinction award by the MN Department of Education

SOFTWARE ENGINEERING EXPERIENCE

Big Data Platform Engineering Intern at Western Digital, San Jose, CA **May 2020 - July 2020**

- Enhanced internal applications and tools, revitalizing and standardizing python code and Docker containers
- Created 3 Splunk data analytics dashboards to monitor web traffic and logins, streamlining the team's efficiency

Software Engineering Intern at Collins Aerospace, Cedar Rapids, IA **Jun 2019 - Aug 2019**

- Developed and booted Linux configuration with bash scripts for the Ultrazed EV Xilinx processor, enabling company-wide testing of operating environments and waveform applications for software-defined radios
- Revitalized 6 Linux drivers using pc-lint debugging, decreasing potential software malfunctions in the radios

TEACHING, LEADERSHIP, AND EXTRACURRICULARS

Undergraduate Research Mentor, UIUC **Aug 2021 – Current**

- Mentored various undergraduate students, introducing them to ML topics such as Recurrent Neural Networks, Generative Adversarial Networks, multimodal alignment, and ML practices such as data preprocessing, feature engineering, model evaluation, model fine-tuning, model compression, hyperparameter tuning and more

ECE 220 Computer Systems & Programming Teaching Assistant, UIUC **Aug 2021 – May 2022**

- Taught advanced use of LC-3 assembly, essential C programming concepts and algorithms, and basic object-oriented design used in modern systems through individually led office hours and lab sections of 40 students
- Formulated rigorous exam questions on coding fundamentals like data structures and recursion for 400+ scholars

ECE 385 Digital Systems Course Assistant, University of Illinois **Aug 2020 – May 2021**

- Assisted students in developing and debugging a logic processor and RAM using transistor chips on a breadboard
- Guided students in learning SystemsVerilog programming and FPGA concepts such as state machines, simulations, testbenches, synchronization, memory layout, timing analysis, and other digital design concepts

IEEE Eta Kappa Nu, UIUC **Aug 2018 – May 2021**

- Led individual tutoring sessions and open review sessions for the following ECE courses: Intro to Computing, Analog Signal Processing, Engineering Probability, Fields and Waves, Semiconductors, Computer Systems, AI
- Volunteered at local outreach events in Champaign, Illinois, teaching kids circuit soldering and programming

PULSE Competitions Committee Director, UIUC **July 2019 - May 2021**

- Coordinated a university wide coding competition and hardware hackathon with more than 80 participants
- Developed programming questions and test cases involving dynamic programming, DFS/BFS, topological sort, etc. from subjects such as AI, parallel programming, and computer security for beginner and advanced levels

iRobotics, UIUC **Aug 2017- May 2018**

- Programmed an audio system and command system of a robot tour guide and drawing robot in Python and ROS

HONORS AND AWARDS

Best Reviewer Award, Unifying Representations Workshop (Unireps) Neurips **Nov 2024**

National Science Foundation Graduate Research Fellow **2023 – May 2026**

Leadership Certificate **2019 - May 2021**

IEEE Eta Kappa Nu ECE Honors, Tau Beta Pi Engineering Honors **2018 - May 2021**

Dean's List Standing, Engineering James Scholars, University Chancellor's Scholar Honors **2017 - May 2021**