Kamalesh Kumar

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Education

University of Massachusetts Amherst **Sep. 2024 – May 2026**
Master of Science in Computer Science (GPA 4.00/4.00) *Amherst, MA*

Indian Institute of Technology (IIT) Madras **Jul. 2020 – May 2024**
B.Tech in Civil Engineering, Minor in Artificial Intelligence & Machine Learning *Chennai, India*

Publications

- Breaking Free from Hand-Crafted Rewards: A Genetic Programming Framework for End-Goal-Driven **Reinforcement Learning** (*under review at 2026 IEEE World Congress on Computational Intelligence (WCCI)*)
- SketchCleanGAN: A generative network for improving 3D CAD model retrieval systems (*Computer & Graphics'24*) [DOI]
- SketchCADGAN: A generative approach for query sketch completion of 3D CAD models. (*Computer & Graphics'23*) [DOI]

Technical Skills

Languages: Python, Rust, C++, MATLAB, LaTeX, C, SQL
Libraries: PyTorch, TensorFlow, JAX, vLLM, triton, transformers, VeRL, DeepSpeed, TensorRT-LLM, OpenCV
Technologies/Frameworks: LangChain, ROS, Ray, Linux, Git, Spark, Hadoop, Kubernetes, Docker, Azure

Experience

Machine Learning Intern **May 2025 – Aug. 2025**
KLA Corporation *Milpitas, California*

- Mitigated catastrophic forgetting by ∼99–100%, retaining ≥95–99% of baseline defect-count performance on previously seen wafer processes during sequential fine-tuning, compared to >200–300% degradation under vanilla fine-tuning.
- Reduced raw defect count by ∼95–98% on previously seen wafers (∼85K → ∼1.5K–4K) while preserving performance on new wafers using interference-aware replay and gradient-constrained optimization.
- Cut fine-tuning time by 50% (7 → 3.5 min) by freezing ∼90% of model parameters, identifying variation-sensitive layers via Fisher Information Matrix over 443K parameters, with negligible loss in accuracy across old and new wafers.

Research Intern (RL) **May 2024 – Aug. 2024**
Mitacs Globalink *Antigonish, Canada*

- Developed a genetic programming framework that improved agent fitness scores by up to 218% in high-dimensional MuJoCo environments (e.g., Humanoid, HalfCheetah) compared to standard human-engineered reward functions.
- Optimized PPO's learning efficiency, enabling agents to reach peak performance in ∼200,000 time-steps versus the >800,000 required by the baseline, effectively reducing training time by 80%.
- Validated the statistical significance of the results ($p < 10^{-4}$) across the 11 tested environments, and surpassed all competing baselines in 82% of tasks, and achieved 22× gains in task alignment coefficient (TAC) over the PPO baseline.

Research Intern (RL) **May 2023 – Aug. 2023**
Paris AI Research Institute *Paris, France*

- Investigated state, action, & kernel perturbing adversaries in RL, and showed theoretical equivalences between them.
- Proved connections between optimal transport distance, optimal couplings, and adversarial risk in RL

Projects

Cost-efficient Agentic LLM Workflows via Reinforcement Learning | UMass Amherst **Dec. 2024 – present**

- Ideated a Pareto-frontier–based framework to optimize agentic LLM workflows under accuracy–latency constraints.
- Enabling query-adaptive workflow selection by composing sub-agent cost–accuracy trade-offs and cost-aware RL.

Continual Reinforcement Learning with Average Reward Criterion | UMass Amherst **Feb. 2025 – May 2025**

- Investigated non-stationary environments in reset-free, continual RL settings requiring lifelong agent adaptation.
- Showed theoretical connections with average-reward POMDPs for modeling partial observability in infinite-horizon tasks.

Autonomous Object Following Robot using ROS and DeepSORT | UMass Amherst **Feb. 2025 – May 2025**

- Built a ROS-based object-following robot using YOLO-v3 and DeepSORT for real-time tracking and re-identification.
- Designed a Dockerized ROS Noetic environment on Triton enabling CUDA-accelerated inference, and real-time control.

Real-Time Fake News Detection in Articles Using Apache Flink | UMass Amherst **Sep. 2024 – Dec. 2024**

- Developed a real-time streaming pipeline with Apache Flink and ONNX-optimized DistilBERT for fake news detection.
- Optimized system performance for throughput, latency, fault tolerance, and resource efficiency in a scalable deployment.

Improving Sketch Queries for Robust Retrieval of 3D CAD Models | IIT Madras **Aug. 2022 – Dec. 2023**

- Designed a two-stage cascaded GAN architecture to facilitate sketch completion of incomplete query sketches.
- Proposed a novel three-branch factorization based on conditional Wasserstein Generative Adversarial Network (GAN) to clean defective sketches and thus improvised a dataset of 58000 CAD sketches.