Varun Sreedhara Bhatt

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Research Interests: Open-Ended Learning, Quality Diversity Optimization, Reinforcement Learning, Multi-Agent Systems, Human-Robot Collaboration, Robot Learning, Evolutionary Computation, Foundation Models

Education

Doctor of Philosophy (Computer Science) | University of Southern California | **GPA: 4/4** [2021-Present]

- Training generally capable intelligent agents by leveraging **foundation models**, **quality diversity** optimization and **scenario generation**
- Applications to **robotics**, **human-robot interaction**, and evaluating **large language models**

Master of Science (Computing Science) | University of Alberta | **GPA: 3.9/4** [2018-2020]

- **Thesis:** Inference-Based Deterministic Messaging for Multi-Agent Communication (supervised by Prof. Michael Buro)
  - Identified issues with multi-agent reinforcement learning methods when learning to communicate
  - Proposed a method based on simulating Bayesian inference of private state for guiding agent's messages

Bachelor of Technology (Electrical Engg) | Indian Institute of Technology Bombay | **GPA: 9.55/10** [2014-2018]

- Minor in Computer Science (GPA: 10/10)
- **Project:** Unsupervised Learning Using Sparse Coding in Spiking Convolutional Neural Networks (supervised by Prof. Udayan Ganguly)
  - Extended the idea of sparse coding into spiking convolutional neural networks
  - Showed improvements in data and energy efficiency compared to traditional CNNs

Publications, Patents, and Pre-prints

- Srikanth, S., Liang, F., Hsu, Y. C., **Bhatt, V.**, Zhao, S., Chen, H., Tjanaka, B., Hwang, M., Saran, A., Seita, D., Tabrez, A., Nikolaidis, S. **"Red-Teaming Vision-Language-Action Models via Quality Diversity Prompt Generation for Robust Robot Policies,"** (under review).
- Srikanth, S., **Bhatt, V.**, Zhang, B., Hager, W., Lewis, C.M., Sycara, K.P., Tabrez, A., and Nikolaidis, S. **"Algorithmic Prompt Generation for Diverse Human-like Teaming and Communication with Large Language Models,"** *arXiv preprint arXiv:2504.03991*. (under review). Arxiv link.
- Qian, C., Zhang, Y., **Bhatt, V.**, Fontaine, M. C., Nikolaidis, S., and Li, J. **"QD-MAPPER: A Quality Diversity Framework to Automatically Evaluate Multi-Agent Path Finding Algorithms in Diverse Maps,"** *arXiv preprint arXiv:2409.06888*. (under review). Arxiv link
- Hedayatian, S.*, **Bhatt, V.***, Tjanaka, B., Lewis, C.M., Sycara, K.P., and Nikolaidis, S. **"Systematic Generation of Diverse Teams for Improved Multi-Agent Collaboration,"** (under review).
- Palmas, M., **Bhatt, V.**, Zhao, S., Nikolaidis, S., Lange, R., and Klauck, M. **"Efficient Quality Diversity Optimization with Monte Carlo Bayesian Sampling,"** Poster at *The Genetic and Evolutionary Computation Conference (GECCO), 2025*. Link
- Zhang, Y., Jiang, H., **Bhatt, V.**, Nikolaidis, S., and Li, J. **"Guidance Graph Optimization for Lifelong Multi-Agent Path Finding,"** in *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2024*. Arxiv link
- Zhang, Y., Fontaine, M. C., **Bhatt, V.**, Nikolaidis, S., and Li, J. **"Arbitrarily Scalable Environment Generators via Neural Cellular Automata,"** in *Advances in Neural Information Processing Systems (NeurIPS), 2023*. Arxiv link.
- **Bhatt, V.**, Nemlekar, H., Fontaine, M.C., Tjanaka, B., Zhang, H., Hsu, Y. C., and Nikolaidis, S. **"Surrogate Assisted Generation of Human-Robot Interaction Scenarios,"** in *Proceedings of the Conference on Robot Learning (CoRL), 2023*. Oral Presentation. Arxiv link.

- Zhang, Y., Fontaine, M. C., **Bhatt, V.**, Nikolaidis, S., and Li, J. **"Multi-Robot Coordination and Layout Design for Automated Warehousing,"** in *Proceedings of the International Joint Conference on Artificial Intelligence (IJCAI), 2023*. Arxiv link.
- **Bhatt, V.***, Tjanaka, B.*, Fontaine, M. C.*, and Nikolaidis, S. **"Deep Surrogate Assisted Generation of Environments,"** in *Advances in Neural Information Processing Systems (NeurIPS), 2022*. Arxiv link.
- **Bhatt, V.** and Buro, M. **"Inference-based Deterministic Messaging For Multi-Agent Communication,"** in *Proceedings of the 35th AAAI Conference on Artificial Intelligence, 2021*. (also accepted at *the AAAI Workshop on Reinforcement Learning in Games, 2021*). Arxiv link.
- Kalyanakrishnan, S., Aravindan, S.*, Bagdawat, V.*, **Bhatt, V.***, Goka, H.*, Gupta, A.*, Krishna, K.*, and Piratla, V.* **"An Analysis of Frame-skip in Reinforcement Learning,"** *arXiv preprint arXiv:2102.03718, 2021*. Arxiv link.
- **Bhatt, V.**, Shrivastava, S., Chavan, T., and Ganguly, U. **"Software-Level Accuracy Using Stochastic Computing With Charge-Trap-Flash Based Weight Matrix,"** in *Proceedings of the International Joint Conference on Neural Networks (IJCNN), 2020*. Arxiv link.
- Shrivastava, S., Chavan, T., **Bhatt, V.**, and Ganguly, U. **"Flash Memory for Low Energy Synapse,"** an Indian Patent Application (Number 201921006118).
- **Bhatt, V.**, and Ganguly, U. **"Sparsity Enables Data and Energy Efficient Spiking Convolutional Neural Networks,"** in *Proceedings of the 27th International Conference on Artificial Neural Networks (ICANN), 2018*.

Work Experience

Research Assistant | *Prof. James Wright, University of Alberta, Canada* [Sep 2020-Aug 2021]

- Worked on modeling human behavior in strategic games
- Collected human behaviour data using **Amazon Mechanical Turk** and analyzed it through **behavioural game theory** models

Internships

- **Samsung Electronics** | *South Korea* [May-July 2017]
  - Created a prototype for a **smart home monitoring system** using anomaly detection
- **Philips** | *India* [May-July 2016]
  - Developed a framework to **automatically generate lip-sync animations** and emotions in a 3D avatar given a text to speak, as a part of a virtual chatbot

Teaching Assistantship

- **Deep Learning and its Applications,** *University of Southern California* [Spring 2024, Spring 2025]
- **Introduction to Robotics,** *University of Southern California* [Fall 2023]
- **Intelligent Agents,** *University of Alberta* [Winter 2020]
- **Reinforcement Learning Specialization,** *University of Alberta on Coursera* [2019-2020]
- **Introduction to the Foundations of Computation,** *University of Alberta* [Fall 2018, Winter 2019, Fall 2019]
- **Partial Differential Equations,** *Indian Institute of Technology Bombay* [Autumn 2016]

Talks

- Invited talk at IIT Bombay on **"Scenario Generation as a Tool for Robust Intelligent Agents"**, 2025.
- **"Generating Scenarios with Surrogate Models"** at USC Summer Robotics Seminar Series, 2024.
- **"Quality Diversity Scenario Generation for Robust Intelligent Agents"** at USC Theta Tau Professor Research Event, 2024, on behalf of the ICAROS Lab.
- Introduction to **"Environment Generation for Generalizable Robots"** at EGG workshop at RSS 2023.

- Talk on **"Training Multiple Intelligent Agents to Communicate"** at the Tea Time Talks 2019, Department of Computing Science, University of Alberta. (video available on YouTube)
- Joint talk with Arta Seify on **"The StarCraft 2 ML Environment"** at the AIIDE-18 Workshop on Artificial Intelligence for Strategy Games.

OUTREACH

- Demonstrated the work on diverse collaborative LLM agents at RSS 2025 and to DARPA.
- Demonstrated robot research on behalf of the ICAROS Lab at the USC Ginsburg Hall ribbon ceremony.
- Represented ICAROS Lab in the Robotics Open House 2024, showing robot demos to K-12 students.
- Led the organization of the first workshop on **"Environment Generation for Generalizable Robots (EGG)"** at RSS 2023.
- Conference/Journal reviews: GECCO 2023, EGG workshop at RSS 2023, ALOE workshop at NeurIPS 2023, HRI 2024, GECCO 2024, TEVC-IEEE, ISRR 2024, ICRA 2025, GECCO 2025, RSS Pioneers 2025, RA-L 2025, NeurIPS 2025 **(top reviewer)**, AAAI 2026, ICRA 2026.

TECHNICAL SKILLS

- **Programming Languages:** Python, C/C++
- **Libraries:** PyTorch, TensorFlow, NumPy, Pandas, Jax, ROS, Isaac Sim, Pygame, HuggingFace Transformers