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Gunbir Singh Baveja

Academic Page
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Work Experience

Undergraduate Teaching Assistant, University of British Columbia **Sept 2025 - Present**
- Sole undergraduate teaching assistant for CPSC 340: Machine Learning and Data Mining. Conducting office hours and grading.

WLIURA Undergraduate Researcher, University of British Columbia **May 2025 - August 2025**
- Analysing activation unit saturation in multi-task and deep continual learning settings.
- Working on diagnosing plasticity loss observed in LLM and continual, sparse-reward RL training under the supervision of Prof. Mark Schmidt. Secured WLIURA (NSERC) and AML-TN funding.

Visiting Student Researcher, KAIST, Seoul, Korea **June 2024 - August 2024**
- Conducted a comprehensive literature review and re-implemented 3+ seminal works on continual reinforcement learning (RL) in non-stationary multi-agent settings, collaborating with Professor Joseph J. Lim to refine methodologies that improved long-term performance stability of online RL methods.

Research Intern, Indian Institute of Technology, Delhi **June 2023 - August 2023**
- Supervised by Dr. Indu Singh, designed a novel multimodal recognition architecture incorporating histogram equalization and pre-activated Inv-ResNet with spatial attention, achieving a 97.2% accuracy in biometric identification.

Machine Learning Intern, Bausch + Lomb **April 2020 - July 2020**
- Applied advanced data augmentation techniques, expanding the training dataset by 50%, improving model robustness against diverse scenarios.
- Leveraged incremental learning methodologies, enabling continuous model improvement and achieving a 20% increase in inventory stock-level prediction accuracy across global datasets.

Projects

Biologically Plausible Supervised Learning with MAP Inference **March 2024 – April 2024**
`https://github.com/sheeerio/map_prop_experiments`
- Scaled the model to deeper networks and empirically evaluated performance degradation trends, identifying key bottlenecks in hierarchical learning via MAP propagation.
- Re-implemented the entire algorithm from scratch using JAX, leveraging functional programming paradigms, automatic differentiation, and JIT-compilation for performance and clarity.

Continual Diffusion and Data-Efficient Exploration in Non-Stationary Tasks **March 2024 - April 2024**
`https://github.com/sheeerio/continual-diffusion`
- Designed and implemented diffusion models for reinforcement learning in non-stationary, vision-based tasks, achieving a 30% improvement in task adaptability across dynamic environments.
- Benchmarked against state-of-the-art algorithms such as PPO, DQN, GoExplore, Rainbow, and Curiosity in Procgen and D4RL environments, demonstrating 20% higher sample efficiency and robustness in long-term performance.

Schizospeak: An Esoteric Programming Language **July 2023**
`http://npmjs.com/package/schizospeak`
- Developed a full-stack Parser, Lexer, and Interpreter in TypeScript, incorporating advanced expressions, declarations, identifiers, and literal types to support dynamic program execution.
- Designed support for Expressions (assignment, binary, call, member), Declarations (variable, function, if, for), and Literals (numeric, string, object), ensuring scalability for creative programming tasks.

Publications

- **Iris and Palmprint Multimodal Biometric Recognition using Novel Preactivated Inverted ResNet and Hybrid Metaheuristic Optimized DenseNet** IEEE TDSC'25
  Indu Singh, Gunbir Singh Baveja*, Shruti Khatri, Sunaina Luthra, Tanvi Singh
- **Exploration and Adaptation in Non-Stationary Tasks with Diffusion Policies** CoRL'24
  Gunbir Singh Baveja*
- **A Unified Noise-Curvature View of Loss of Trainability** NeurIPS'25 OPT
  Gunbir Singh Baveja*, Mark Schmidt

Presentations

Scalable Unsupervised RL with Metric-Aware Abstraction **June 2024**
KAIST · Reinforcement Learning Reading Group

Efficient Policy Updates in Continual Reinforcement Learning Frameworks **March 2024**
KAIST · Cognitive Learning for Vision and Robotics Group

Education

Bachelor of Science, Major in Computer Science **2022-2027**
University of British Columbia, Vancouver

- GPA: 3.95/4.0, Dean's List 2023, 2024, 2025
- Software Lead@Open Robotics, Undergraduate Mathematics Society, UBC Sikh Association
- Relevant Coursework: **Graduate** Deep Reinforcement Learning (top $\sim 2/32$, A+); **Undergraduate** Machine Learning (A+), Advanced Data Structures & Algorithms (A), Statistical Inference (A), Linear Algebra (A+), Calculus III (A+), Data Science (A+)

Awards and Grants

- **Work Learn International Undergraduate Research Award:** NSERC, nominated by UBC Computer Science ($6,000)
- **Undergraduate Research Award:** AML-TN ($5,000)
- **International Work Terms Grant:** UBC Vancouver Co-Op ($1,000)
- **Outstanding International Student Award:** UBC Vancouver ($10,000)
- **Second Award, Global Youth Science and Technology Bowl:** independent project. Awarded by The Hong Kong Federation of Youth Groups.
- **Grand Award, IRIS National Fair 2020:** Selected amongst around 1000 teams to represent India at the Intel Science and Engineering Fair. Awarded by the Ministry of Science and Technology of India.
- **Finalist, Intel Science and Engineering Fair 2021.** Represented India at the largest science fair in the world.
- **Most Outstanding Exhibition in STEM, IRIS National Fair:** awarded by Yale Science and Engineering Association at the IRIS National Fair.
- **Bronze Medal, Asia Pacific Linguistics Olympiad (APLO):** selected as member of alternate team for India at the International Linguistics Olympiad (IOL) 2022. *APLO Rank 8, PLO Rank 11.*
- **Top 10 Leaderboard, NeurIPS Concordia Challenge:** Developed cooperative AI agents in text-based environments, achieving a top 10 position on the leaderboard among international participants.