

# Rishav Aryan

Pleasanton CA | +1 511 604 8902 | [rishavaryan058@gmail.com](mailto:rishavaryan058@gmail.com) | [LinkedIn](#) | [Github](#) | [Website & Papers](#)

## Summary

Research engineer specializing in post-training and alignment of reasoning models and multimodal agents, implementing reinforcement learning loops (GRPO, PPO) and self-adaptation frameworks to optimize performance. Proven ability to design, reproduce, and scale ML research under extreme compute constraints, including distributed GPU infrastructure and robust evaluation pipelines.

## Publications

- Learning to Act Anywhere: Experience-Based Similarity for Universal Interface Agents..*First Author, ACL 2026 Submission training-free cross-platform UI agents using FAISS-based Elastic Visual Memory, achieving ~40% higher task success under interface perturbations with 83 ms per-step latency.*
- Multimodal Event Detection: Current Approaches and Defining the New Playground through LLMs and VLMs..*Co-Author, NLDB 2025 , systematic evaluation of multimodal ED identifying failure modes of generative LLM/VLM approaches and conditions where supervised fusion models outperform.*

## Independent Research Projects

### Enough Thinking - Efficient Reasoning via RL-Driven Self-Adaptation | [Link](#)

- Frontier reasoning models (e.g., DeepSeek-R1) exhibit "rumination," consuming excessive tokens on simple logic and increasing inference costs.
- A base 0.5B LLM achieved a GSM8K accuracy of 0.20 and required 218 tokens per query without Induction of Explicit Verification.
- Engineered a proof-of-concept system to incentivize token efficiency and permanent weight-internalization of reasoning patterns using limited compute (Google Colab).
- Implemented Group Relative Policy Optimization (GRPO) from scratch to induce emergent reflection; designed a SEAL-inspired self-edit loop utilizing LoRA and ReSTEM RL to "cache" logic into parameters.
- Improved accuracy to 0.30 (+50%) while reducing token overhead by 48% (218 → 112 tokens); deployed via Model Context Protocol (MCP) for deterministic tool-use via API.

### NetGuard: Autonomous Multi-Agent Framework for NIST-Compliant Threat Detection | [Link](#)

- Real-time threat detection lacks automated coordination between analysis and NIST-compliant response.
- Manual log enrichment resulted in high "time-to-remediate" latency and inconsistent classification.
- Led the design of a serverless multi-agent system (Ingestor, Analyzer, Aggregator) for automated traffic analysis.
- Built modular agents using SecureGPT and AWS Lambda; implemented reflexion feedback loops for system self-improvement via API calls.
- Achieved 94.5% accuracy across 6,000+ data points, demonstrating expertise in "model coordination".

## Experience

### George Mason University

**Jul 2025 - Present**

#### *Research Assistant --- Machine Learning & Reinforcement Learning*

- Financial time-series data is highly non-stationary; standard RL policies often collapse or "overfit" during sudden market regime shifts.
- Static PPO-based allocation models failed to maintain alpha when market volatility spiked. Baseline performance was limited to a Sharpe ratio of ~0.85 – 0.95 and a Sortino ratio of ~1.10, with an alpha near +0.05 that vanished during regime changes.
- Engineered a regime-aware RL system capable of autonomously distinguishing between market states and deployed as a scalable distributed system to ensure steerable and stable policy learning.
- Developed latent state representations using VAE + GMM and implemented hierarchical PPO-based policies with realistic risk constraints, leveraging probability and statistics to optimize performance.
- Achieved a consistent Sharpe ratio of 1.23 and positive alpha of +0.23, satisfying the engineering rigor required for regulated foundation models for deployment in products.

### Wall Street Quants

**Jul 2024 - Oct 2024**

#### *Quantitative Research Intern*

- Cryptocurrency markets exhibit extreme non-stationarity and "regime blindness," where standard momentum models frequently collapse or suffer from excessive drawdown during sudden market reversals.
- Baseline trading models were achieving 18% annualized returns but lacked the volatility filters and calibration necessary to survive high-variance periods across the top-10 crypto assets.
- Engineered and calibrated a suite of adaptive momentum and reversal strategies designed to balance high-yield returns with rigorous, real-time risk management.

- Developed and backtested strategies using Python and software engineering best practices, implementing RSI and moving average calibrations across thousands of simulated scenarios to identify the most stable parameters.
- Developed and backtested algorithmic trading strategies, applying statistics and calculus to boost annualized returns from 18% to 25% (+38% improvement) and improve the Sharpe ratio by 15%.

## Foxformula

May 2022 - Jul 2022

### Machine Learning Intern

- HR analytics at scale often lack predictive depth, leading to reactive decision-making and significant "human-in-the-loop" latency when identifying employee dissatisfaction or promotion eligibility.
- The department relied on manual data triage, costing 10+ hours weekly in analysis and failing to provide a structured pipeline for proactive strategic initiatives.
- Developed and deployed an automated, end-to-end ML pipeline to identify key drivers of dissatisfaction and accurately predict promotion pipelines with high interpretability.
- Implemented ensemble models (XGBoost, Stacking) and engineered specialized tenure and skill-gap features; automated the entire deployment via AWS and TensorFlow.
- Achieved 90% precision (+15% improvement in accuracy) and saved 10+ hours weekly, transforming a manual bottleneck into an automated, data-driven system.

## Technologies

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- **Programming Languages:** Python, SQL
- **ML & Frontier Reasoning:** Transformers, Preference Optimization (RLHF/RLAIF), Reinforcement Learning , LoRA, Natural Language Processing , GMMs, VAEs
- **Agentic & Multimodal Systems:** Vision-Language Models(VLM), Retrieval-Augmented Generation (RAG), Model Context Protocol (MCP)
- **Infrastructure & Scale:** vLLM, PyTorch, FAISS, FastAPI, Docker, AWS (Lambda, EC2, S3), Distributed Systems, TensorFlow
- **Research Practice:** Problem Framing, End-to-End ML Pipelines, Ablation Studies, Robustness Evaluation
- **Core Competencies:** Software Engineering, Linear Algebra, Calculus, Probability, Statistics

## Education

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### George Mason University

Aug 2023 - May 2025

*Masters, Data Analytics and Engineering*

### Vellore Institute of Technology (India)

Jun 2019 - Jul 2023

*Bachelors, Electronics and Communication Engineering*

## Achievements

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- **Technical Peer Reviewer | Expert Systems with Applications (Elsevier):**(Invited to perform rigorous technical peer reviews for 3+ manuscripts in a top-tier Q1 journal (Impact Factor: 8.5).)
- **Kaggle AIMO-3 Progress Prize Participant:**(Developed a **Hybrid Reasoning-Execution** system with **SEAL-inspired self-adaptation** for Olympiad-level mathematics.)
- **International Keynote Speaker | Parwati Science College (India):**(Invited by the Organizing Committee to deliver a technical keynote at the **UGC-Sponsored International Seminar 2026**.Recognized for "distinguished scholarly contributions" in AI and human civilization.)