

NIRODYA PUSSADENIYA

PhD Student

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PROFESSIONAL SUMMARY

PhD student researching reinforcement learning driven multi-agent systems, with a focus on simulation-based training environments for autonomous decision-making. My work sits at the intersection of agentic AI, explainability, and human-machine trust, exploring how RL-based agents can collaborate effectively and transparently with humans. I complement this with over four years of industry experience designing and deploying production-grade LLM pipelines, RAG systems, and AI agent frameworks across diverse real-world applications.

RESEARCH INTERESTS

Multi-Agent System • Reinforcement Learning • LLM Post training • Trust-Aware • Human-AI Collaboration • Knowledge Graphs • Large Language Models (LLMs)

PUBLICATIONS

CARA: A Hybrid Framework Integrating Swarm AI Agents and Knowledge Graphs for Advanced LLM Reasoning 12/2024

— 6th International Conference on Advancements in Computing 2024

<https://ieeexplore.ieee.org/document/10851065>

Nirodya Pussadeniya, Dr. Ruchira Wijesinghe, Dr. Udaya Wijenayake, Dr. Bhagya Silva

Won the **Best Paper Award**. Presented a novel framework for enhancing the structured reasoning abilities of large language models (LLMs) using agentic workflows, achieving state-of-the-art results in reasoning tasks.

Affective-CARA: A Knowledge Graph Driven Framework for Culturally Adaptive Emotional Intelligence in HCI 06/2025

<https://www.arxiv.org/abs/2506.14166>

Nirodya Pussadeniya, Dr. Bahareh Nakisa, Dr. Mohammad Naim Rastgoo

Developed **Affective-CARA**, a knowledge graph-driven agentic framework that integrates **cultural emotion knowledge, valence/arousal/dominance annotations**, and reinforcement learning to generate emotionally sensitive, culturally adaptive responses—demonstrating a **61% reduction in cultural representation bias** and superior sentiment alignment over baseline models.

AWARDS

Asia Pacific ICT Alliance Awards (2024) | Runner-Up in Tertiary Category

Recognized as the Runner-Up for FootEdge Pro, an AI-powered soccer performance analysis tool that automates event detection, tracking, and advanced analytics.

Best Paper Award International Conference on Advances in Computing (ICAC 2024)

Awarded for the paper titled "CARA: A Hybrid Framework Integrating Swarm AI Agents and Knowledge Graphs for Advanced LLM Reasoning", recognizing its innovative contribution to enhancing LLM performance using agentic workflows.

NBQSA Silver Award – Tertiary Category National ICT Awards (2024)

Achieved the Silver Award for FootEdge Pro, highlighting excellence in innovation and technical development in sports analytics.

Best Employability Skills Achiever (BESA) Faculty of Engineering, University of Sri Jayewardenepura – 2nd Runner-Up

Recognized for demonstrating outstanding employability skills, leadership, and technical abilities among engineering graduates.

EXPERIENCE

Monash University – Department of Data Science and Artificial Intelligence

Research Assistant

06/2026 - Present

- Designing a causal trust model for multi-agent reinforcement learning (MARL) environments to improve inter-agent coordination, combining a discriminative teacher/oracle trust signal with a learned concept bottleneck network.
- Developing a neurosymbolic concept extraction layer (rule-based event detection + differentiable predicate learning) to translate raw agent state into interpretable trust-relevant concepts (e.g., blocking, handover success, proximity).
- Building a causal trust graph that models cause-and-effect relationships between agent concepts and trust, enabling trust estimation to generalize the teacher model's behavior.
- Architecting a domain adapter for cross-domain concept mapping, allowing the trust model to transfer and retrain across varied environment layouts.
- Tech Stack: Python, PyTorch, causal inference methods, symbolic reasoning, multi-agent RL environments.

EXPERIENCE

Synacal Private Limited

Sri Lanka

Machine Learning Engineer

08/2023 - 10/2025

- Architected and deployed advanced RAG pipelines using LangChain, LlamaIndex, Pinecone, and AWS – powering intelligent knowledge management and chatbot ecosystems with 40% faster response accuracy.
- Engineered AI Agent frameworks (AutoGen, CrewAI, LangGraph) to automate complex workflows and reduce manual intervention by over 60% across internal and client-facing systems.
- Developed Markaive, an AI-powered platform automating market research and content generation, integrating multi-agent reasoning and summarisation to accelerate marketing intelligence by 3x.
- Collaborated cross-functionally with software and data teams to ensure seamless product scalability, compliance, and integration with proprietary Synacal APIs and client infrastructures.
- Tech Stack: Python, FastAPI, LangChain, LlamaIndex, Pinecone, AWS, OpenAI GPT, AutoGen, CrewAI, LangGraph, Docker, PostgreSQL.

Velaris

Sri Lanka

AI Engineer

03/2025 - 10/2025

- Developed intelligent transcript-analysis and note-generation modules leveraging transformer-based summarisation and topic modelling (LDA, BERT, GPT-based models).
- Optimised Fact Factory, a large-scale event summarisation engine handling millions of customer interaction records with latency under 1s.
- Integrated LLM pipelines across multi-tenant systems using asynchronous microservices (FastAPI, AWS SQS, MongoDB, Redis).
- Collaborated with product teams to architect data ingestion and embedding pipelines enabling RAG-based contextual retrieval and reasoning.
- Tech Stack: Python, PyTorch, FastAPI, AWS (S3, SQS, Lambda), MongoDB, OpenAI API, Hugging Face Transformers.

ASCII Corporations (PVT) Ltd.

Sri Lanka

Machine Learning Engineer (Contract)

03/2024 - 08/2024

- Automated marketing report generation using AI agents, improving campaign efficiency and ROI with intelligent automation (AutoGen, CrewAI, LangGraph, OpenAI).
- Developed and deployed advanced NLP models for data-driven marketing strategies, leveraging cutting-edge frameworks like LLAMA3 and Groq.

Kainovation Technologies (PVT) Ltd.

Associate Machine Learning Engineer

10/2021 - 08/2023

- Engineered **InsurePULSE**, an AI-based system for insurance companies, delivering backend ETLs, report generation, and cloud deployment (FastAPI, Azure, PostgreSQL).
- Built **Docusfy**, an AI-driven document query tool for HR firms, integrating LangChain and Elasticsearch for high-efficiency search capabilities.
- Developed a Sensitive Data Filtering tool as a PoC, enhancing data security for enterprise-level AI chat systems (NLP, Python, AWS).
- Developed ML models for finance and medical domains, streamlining workflows and improving prediction accuracy.
- Built and tested a PoC for **Prescriptio**, an AI-based prescription tool, utilizing AWS, FastAPI, and React.
- Designed efficient data pipelines using Kafka and socket programming to optimize data transmission processes.

EchonLabs Private Limited

Intern AI Engineer

05/2021 - 10/2021

- Built AI models for NIC-based information extraction and verification systems. Contributed to **AI-CORE**, an AI-driven financial tool, by designing and deploying predictive models.
- Co-authored a research paper on ID Card verification using AI, showcasing expertise in model deployment and security.

EDUCATION

Deakin University & Coventry University (Cotutelle PhD)

Melbourne, Australia

Doctor of Philosophy (PhD) – Explainable AI & Human-Machine Trust

2025 - Present

University of Sri Jayewardenepura

Colombo, Sri Lanka

Bachelor of the Science of Engineering Honours

11/2019 - 07/2024

COMPETITIONS & HACKATHONS

Team Blazers – Finalist, TadHack Sri Lanka 2022 (Team Lead)

Led the team to the finals by developing an innovative solution for communication and technology challenges.

Team Blazers – Finalist and Most Popular Idea, INTELLIHACK2 (Team Lead)

Led the team to achieve the "Most Popular Idea" award for an AI-driven solution, organized by IEEE CS Student Branch Chapter of UCSC.

Top 3 – INTELLIHACK MASTER Machine Learning Hackathon (Individual)

Ranked among the top 10 by building a high-performing machine learning model for the competition.

Finalist, CS-INSL Competition 2022 (Individual)

Successfully showcased advanced problem-solving and coding skills as an individual finalist.

TECHNICAL EXPERTISE

Domains:
Machine Learning · Deep Learning · Large Language Models (LLMs) · Reinforcement Learning · Multi-Agent Systems · Explainable & Trust-Aware AI · Knowledge Graphs · Human–AI Collaboration

Technologies & Tools:
Python · PyTorch · TensorFlow · FastAPI · LangChain · LlamaIndex · AutoGen · CrewAI · LangGraph · Hugging Face Transformers · Anthropic Claude · Ollama · vLLM · DeepSpeed · LoRA / PEFT · Weights & Biases · Pinecone · Qdrant · FAISS · AWS (S3, Lambda, Bedrock, SQS, ECS) · Docker · Kubernetes · MongoDB · PostgreSQL · Redis · Ray · MLflow · Gradio · Streamlit · Git · RESTful APIs · CI/CD Pipelines

PUBLIC SESSION ENGAGEMENTS

Build with AI – GDG Sri Lanka	05/2025
<i>Agentic Reasoning Using GraphRAG with Neo4j and Vertex AI's Reasoning Engine</i> – demonstrated real-world applications of graph-structured retrieval and agentic orchestration.	
Global AI Bootcamp (Colombo)	03/2025
<i>Reasoning Capabilities of Agentic Systems</i> – discussed the progression of autonomous reasoning in multi-agent architectures.	
MLOps Community (Sri Lanka)	01/2025
<i>AI Agents as Neuro-Symbolic Systems</i> – explored the intersection of symbolic reasoning and LLM-based agents for scalable MLOps.	
CENSOC – University of Sri Jayewardenepura	07/2025
<i>Keynote: What Data Taught Us</i> – explored lessons from large-scale data systems and AI adoption in academia and industry.	
University to Industry – Orientation Program, Faculty of Engineering (USJ)	06/2025
<i>Bridging Academic AI Research to Real-World Applications.</i>	
Google I/O Extended – GDG Sri Lanka	07/2024
<i>Future is Agentic</i> – keynote session on the evolution of AI agents and their role in enterprise intelligence.	
Global AI Bootcamp - Colombo	12/2023
<i>Can LLMs Really Reason?</i> – deep-dive session analysing the reasoning limitations and emergent intelligence of modern large language models.	

VOLUNTEERING

Omdena Sri Lanka Chapter	
Co-Chapter Lead	2023
Led and coordinated AI-driven community projects, fostering collaboration and knowledge sharing among AI enthusiasts to solve real-world problems.	
SEDS Sri Lanka Aeronautical Division	
IT Manager	2021 - 2022
Managed IT infrastructure and digital operations, supporting the division's aeronautical research and outreach initiatives.	