Subhransu S. Bhattacharjee

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GitHub ▪ LinkedIn ▪ Google Scholar

Bio: PhD researcher advancing generative and vision-language models to represent spatio-temporal uncertainty for reliable robotic decision-making; interests also include time-series uncertainty analysis in noisy regimes, convex optimization & optimal transport.

Education

Doctor of Philosophy — **Resident Scholar**
School of Computing, Australian National University, Australia — *Apr 2023 – Expected Apr 2027*
- **Thesis Topic: Probabilistic 3D Spatio-Semantic autonomous reasoning under dynamic uncertainty with Generative Models**
- **Supervisors:** Dr. Rahul Shome, Dr. Dylan Campbell, and Prof. Stephen Gould

Bachelor of Engineering — **First Class Honours**
School of Engineering, Australian National University, Australia — *Jul 2018 – Dec 2022*
- **Major:** Mechatronic Systems Engineering (*Merit List* in the Honours cohort)
- **Minors:** Mathematics and Electronic Communication Systems
- **Certifications:** Game Theory, Stanford; Machine Learning Production; Project Management, Google; Financial Markets, Yale
- **Thesis project:** Whiplash Gradient Descent Dynamics (Supervisor: Prof. Ian Petersen)

Summer Schools: Robotic Vision Summer School (2024); London School of Economics (2019): Practical Machine Learning

Selected Publications & Preprints

Subhransu S. Bhattacharjee, Dylan Campbell & Rahul Shome: *Believing is Seeing: Unobserved Object Detection using Generative Models. IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2025. paper | project page.
Pre-trained generative models can infer spatio-semantic distributions of occluded and out-of-frame objects across 2D, 2.5D, and 3D scenes by implicitly learning contextual scene relationships.

Subhransu S. Bhattacharjee, Hao Lu, Dylan Campbell & Rahul Shome: *Into the Unknown: Using Generative Models to Sample Priors of Environment Uncertainty for Planning in Configuration Spaces. arXiv:2510.11014*, 2025. arXiv.
Leveraging pre-trained generative model priors as uncertainty quantifiers enables motion planning algorithms to remain robust across distributions of partially observed plausible environment configurations.

Subhransu S. Bhattacharjee & Ian Petersen: *Analysis of the Whiplash Gradient Descent Dynamics. Asian Journal of Control* (Special Issue), Wiley, 2023. DOI: 10.1002/asjc.3153.
A feedback-based inertial gradient method with adaptive damping achieves provable polynomial and exponential convergence rates that extend classical optimization theory to high-dimensional settings.

Achievements, Scholarships & Awards

2025 VC Travel Grant (A$ 2500), Australian National University for traveling to CVPR 2025.
2025 Invited attendee (fully funded £5000), *Citadel & Citadel Securities PhD Summit*, London.
2025 Residential Mentor Scholarship, ANU for the year 2025
2024 Optiver PhD Quant Lab Program (select participant) fully funded A$ 2000.
2023 ANU International University Research Scholarship (for 4 years).
2023 Higher Degree by Research Merit Stipend (completely covers tuition).
2022 Highly Recommended Paper in the *Asian Control Conference* and Best student reviewer award.
2022 Highest in the course ENGN4627: Robotics.
2021 High Commendation award for undergraduate student paper in *Australia & New Zealand Control Conference*.
2021 ANU Chancellor's International Scholarship for academic merit.
2020 ANU-VIT International Transfer Program scholarship: 8th highest standing GPA in cohort.
2019 Chancellor's Special Achiever Award, VIT for scoring highest in Engineering Statistics and Differential Eqns course.
2019 Google & HUL Hackathon — FMCG supply chain operational modeling using LSTMs: Finalist.

Internships

Optiver APAC, Sydney
Quantitative Research Intern (Machine Learning) *Nov 2024 – Feb 2025*
Analyzed large-scale market and microstructure data; identified inefficiencies in the **Korean** market & Co-built a proprietary real-time ML decision system; achieved **94%** accuracy in historical backtests.

Decimal Point Analytics, India
ML Research Intern — Financial NLP, Supervisor: Mr Paresh Sharma, MD *Dec 2020 – Jan 2021*
Engineered and optimized a financial metadata store for a Transformer-based QA system for large scale document analysis, coordinated client reviews for product reassessment.

Academic Research

Research School of Management, Australian National University **Commonwealth Bank of Australia**
Graduate Research Assistant — FinTech & AI, PI: Dr Priya Muthukannan *Sep 2023 – Sep 2024*
- Analyzed open-banking regimes using a dynamic-capabilities lens to inform strategy.
- Delivered introductory data-analysis instruction for Business Information Systems.
- Built assessment frameworks for banks AI adoption and responses to technological shifts.

School of Computing, Australian National University
Undergraduate Researcher — Foundational Deep Learning, Supervisor: Prof Richard Hartley, FAA *Mar 2022 – Jun 2022*
- Studied invertibility of differentiable mappings with neural networks; achieved a **72%** hit rate (RMSE criterion) using dense positional encodings.
- Demonstrated limitations of normalizing flows for global invertibility, highlighting locality of neural function approximation.

School of Engineering, Australian National University
Undergraduate Researcher — Control & Optimisation, Supervisor: Prof Ian Petersen, FAA *Dec 2021 – Mar 2022*
- Designed Lyapunov-based approaches for predicting convergence rates in high-resolution ODE models; developed a complexity model for feedback systems without closed-form solutions.
- **Selected papers:**
  - ***Analysis of Closed-Loop Inertial Gradient Dynamics*** — Asian Control Conference (ASCC) 2022.
  - ***A Closed-Loop Gradient Descent Algorithm Applied to Rosenbrocks Function*** — ANZCC 2021.
- Open-source code: 1ssb/Whiplash.

Teaching & Service

- **Head Tutor, Building Cyber-Physical Systems** — School of Cybernetics, ANU (Mar 2025–Nov 2025): Co-designed and delivered project-based modules across microprocessors/robotics/ML; led NAO labs; coordinated assessments.
- **Tutor, Introduction to Machine Learning** — School of Computing, ANU (Jun 2025–Nov 2025): Taught ML mathematics and optimization; marked exams for **250** students; ran tutorials and assessed projects.
- **Tutor, Power Systems & Control Theory** — School of Engineering, ANU (Jul 2022–Sep 2023): Ran labs (ENGN8824, **12** MSc); led workshops (ENGN4628, **34**); delivered targeted tutoring (ENGN4625, **16**).

Reviewer: CVPR 2026; AAAI 2025; IROS 2025; ICRA 2025–2026; Asian Journal of Control (2023); American Control Conference (2022); Australia & New Zealand Control Conference (2021–2022).
Volunteering: Teacher at Friends of Tribal Society, 2017-18; Set4ANU Mentor 2023-24; Techlauncher Manager 2024

Skills

- **Languages:** Python; C/C++; CUDA; Embedded C; MATLAB; JavaScript; HTML/CSS; LaTeX
- **LLM/VLM APIs & Models:** OpenAI API (GPT-4o/4.1); Anthropic (Claude 3.5 *Sonnet*/Haiku); Google AI Studio (Gemini 1.5 Pro/Vision); Alibaba (Qwen2/Qwen2-VL); Meta (Llama 3/3.1); Mistral (Large; Pixtral); LLaVA 1.6; Florence-2; BLIP-2; CLIP; GroundingDINO; SAM/SAM2; Hugging Face Inference; Replicate; AWS Bedrock; Azure OpenAI
- **Vision & 3D & Generative:** Diffusion; segmentation/detection; 3D reconstruction; TorchVision; Blender, Meshlab; OpenCV; Open3D; PyTorch3D; Trimesh
- **Performance/Systems:** Mixed precision (AMP); `torch.compile`; Inductor/TorchDynamo; custom CUDA kernels; Numba; CuPy; ONNX Runtime; TensorRT; Triton (GPU DSL); Nsight Systems/Compute; JAX
- **Data/Cloud/MLOps:** PySpark; SQL; Airflow; FastAPI; REST; Weights&Biases; Git/GitHub; CI/CD (Actions)
- **Containers & HPC:** Docker; Podman; Apptainer (Singularity); NVIDIA Container Toolkit; Conda/Mamba; Lmod; SLURM

Selected Open Source Contributions: TorchKAN: Simplified KAN Model with Variations; Depth Anything V1/V2; Mangrove: A Dynamic Data Management System for Advanced AI Applications; Webcamdinov2: Video Inferencing with Webcam using DINOv2; Camera Ray Transformation Visualizer: A StreamLit App; RGB-Depth Cropper NPMv2.5.0