

Education

University College Cork

BSc (Honours) in Data Science & Artificial Intelligence

Cork, Ireland

Sep 2024 – May 2028

Experience

Rinn AI (formerly Insight SFI Centre)

Undergraduate Researcher

Ireland

Oct 2025 – Present

Technical Lead: Tool World Model (UCC & IBM Research)

Supervisors: [Dr Harry Nguyen](#) (UCC), [Dr Hoang Thanh Lam](#) (IBM), [Prof Barry O'Sullivan](#) (UCC)

Manuscript in preparation for ICLR 2027.

- Quantified what API documentation leaves out: it says what each tool does, not which tool's output feeds which tool's input. On AppWorld (9 apps, 457 APIs), 11.7% of the handoffs human solutions rely on are stated nowhere, including every login-name handoff, which 97% of tasks need; a graph predicted from the docs reaches 3% of goals.
- Designed and built a Bayesian active learner that recovers this structure by executing calls, with no documentation, demonstrations, annotation or language model: information-gain call selection, credit assignment from error messages, and a foreign-key-style value-inclusion prior that survives renaming the suite.
- Showed the learner discovers its own workflows in three unseen worlds: every workflow differs from the human solution, and every route into a protected function uses an undocumented handoff. Its 1,292 learned handoffs match or beat a 42,307-edge expert graph; a planner over them performs on a par with a Gemini 3.5 Flash agent reading the docs.
- Diagnosed why an LLM prior at 0.89 expert agreement collapsed exploration (295 → 51 functions reached): information gain vanishes for confident beliefs. Fixed it by decoupling the call-pricing prior from the execution-only gain.

University College Cork

Web Development Intern

Ireland

Jun – Aug 2025

- Rebuilt a fragmented booking system as a FastAPI stack with secure integrations, deployed on GCP.

Projects

HERMES: Differentiable Exoplanet Transit Detection and Vetting [[code](#), [article](#)]

- JAX pipeline that finds and vets transiting planets in Kepler photometry: matched-filter periodogram, differentiable Mandel-Agol fit, CNN+Transformer vetter; test ROC-AUC 0.979 on 3,250 TCEs from 2,000 stars, split by host star.
- Used end-to-end gradients to audit the pipeline: traced its detection boundary with $4.1 \times$ fewer searches than bisection, found the search loses 9.4 SNR points to duty-cycle discretisation, not template shape, and showed its physics-informed feature was exactly redundant ($R^2 = 1.000000$) and after repair moves the classifier by < 0.007 AUC.

Attnax: Attention for JAX [[code](#), [docs](#)]

- JAX/Flax NNX library of composable attention biases and transformer parts JAX and Flax lack: ScoreMod/MaskMod algebra, RoPE, ALiBi, ViT, ring and linear attention, JIT-compatible paged KV caches with single-trace decode.
- Lowers causal, windowed and padding masks onto `jax.nn.dot_product_attention`'s native arguments, byte-identical `jaxpr` to a hand-written call, asserted in CI; block-sparse kernel skips dead tiles, 44–77% fewer matmuls.

xView Detector: Satellite Imagery Object Detection [[code](#)]

- Unified xView framework spanning three detector families (Faster R-CNN, YOLOv8, RT-DETRv2) behind one tiling pipeline and typed CLI; custom Faster R-CNN variant (APEX) with class-balanced focal loss for small, imbalanced objects.

Adaptive Activation Functions: Empirical Replication in Java [[code](#)]

- Independent Java replication of Jagtap et al. (2020): evaluated convergence across function approximation, PINNs and image classification, identifying where architectural simplifications destabilise adaptive scaling. [[report](#)]

Extracurriculars

UCC Rocketry (Avionics ML Engineer, Jan – Oct 2025): led the onboard vision stack for terrain recognition.

Microsoft Cybersecurity Hack 2024 (Team Leader): 3rd place; identified critical vulnerabilities in an Azure database.

Skills & Technologies

Programming: Python, C++, Go

ML: JAX (Flax NNX), PyTorch, TensorFlow

Systems & Data: Docker, Kubernetes, GCP, FastAPI, PostgreSQL, Kafka