

# Brandyn Leonard

Co-Founder & Research Lead | ML Architecture, Network Theory, Cognitive Science

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## SUMMARY

Self-taught research lead and co-founder architecting original systems across machine learning, traffic network coordination, and cognitive science. Lead architect of LOLM (hybrid Transformer-SSM, 1.57B parameters), a live traffic intelligence platform monitoring Phoenix freeways 24/7, and the EGC consciousness framework. All work is original, patent-protected, and validated on production data. Supported by Google TPU Research Cloud.

## PROJECTS & RESEARCH

### LOLM — Latent Order Language Model

Lead Architect | 2024 – Present

Qira LLC | [U.S. Patent #64/002,166](#)

- Designed hybrid Transformer-SSM dual-stream architecture separating language into surface and latent representations
- Discovered 8,645x dependency inversion: the 29% minority SSM path is exponentially more essential than the 71% majority Transformer path
- Achieved **43% faster convergence** at 300M parameters and **15% lower perplexity** at 1.57B parameters vs. matched baselines
- Achieved **+18% HellaSwag improvement** over matched baseline, confirming perplexity advantage translates to task performance
- Scaled training from single H200 GPU (20M params) to 40+ Google TPU v4 chips simultaneously (1.57B params)
- Developed 7 complementary training losses and 5-stream fan-out architecture guided by three original theoretical frameworks
- Replicated results across three datasets (FineWeb, C4, The Pile) on both GPU and TPU — advantage holds at every matched checkpoint

### Phoenix Traffic Intelligence (PTI)

Lead Architect | 2025 – Present

Qira LLC — *Live production system*

- Built real-time traffic intelligence platform monitoring 8 Phoenix freeway corridors 24/7 using AZ-511, HERE Routing API, and AI analysis
- Designed original network coordination framework detecting operating-band regimes in real traffic data
- Validated on full METR-LA benchmark: **207 sensors, 34K+ time points, 1,191 edges**, Max-T Z\* > 4.8 (p < 0.01)
- System generates cascade predictions, crew dispatch recommendations, and FHWA delay cost analysis every 2 minutes
- Accumulated **408K+ corridor snapshots** and **51K+ network snapshots** with projected annual savings of ~\$3.99M
- Deployed on cloud infrastructure with 99.9% uptime, serving live dashboards for public and internal stakeholders

### EGC — Expression-Gated Consciousness

Principal Investigator | 2025 – Present

Qira LLC — *Live empirical study*

- Originated gating function  $g(\mathbf{K}) = 4\mathbf{K}(1-\mathbf{K})$  quantifying how emotional knowledge gates conscious expression
- Designed and deployed live empirical study with **60+ participants** and three confirmed response types
- Stable Pearson correlation from N=14 forward, validating theoretical predictions with real data
- Published preprint on Zenodo; seeking ArXiv endorsement for broader distribution

## EXPERIENCE

### Co-Founder & Research Lead

Nov 2024 – Present

Qira LLC — *Littleton, CO*

- Co-founded research-driven technology company building intelligent systems for complex networks
- Lead all technical architecture decisions across ML, traffic intelligence, and cognitive science verticals
- Managed cloud infrastructure (Google TPU v4, DigitalOcean) and production deployments
- Engaged with NYU faculty on network coordination theory applications

## TECHNICAL SKILLS

[PyTorch] [JAX / TPU] [Python] [CUDA] [NumPy / SciPy] [Transformers] [State Space Models] [Kuramoto Theory] [FastAPI] [React / TypeScript] [Linux / Cloud Infra] [Git] [SQLite / PostgreSQL] [Network Theory] [Statistical Validation]

## EDUCATION

**Self-Directed** — Applied mathematics, machine learning, network dynamics, and cognitive science. Validated through patent-protected original work, live production systems, and peer-reviewed methodology.

## RECOGNITION

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- **Google TPU Research Cloud** — Granted access for large-scale ML training (2025–present)
- **U.S. Provisional Patent #64/002,166** — Network coordination methods (filed March 2026)
- **NYU Faculty Engagement** — Invited discussion on network coordination frameworks