William Lin

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Education

University of Waterloo — Waterloo, ON
Computer Science, Co-op — *Sept. 2026 – Expected 2031*

- **Relevant Coursework (Advanced Level)**: MATH 145 Algebra, MATH 147 Calculus, CS 145 Functional Programming

Research Experience

Student Researcher — July 2025 – Present
Tang Lab, University of Washington — *Supervisor: Asst. Prof. Johnathan C.Y. Tang*

- Designed and built XCAVATE end-to-end, an original method and platform mapping human concepts onto standardized brain regions using cross-model replicated LLM inference, from data collection through statistical validation.
- Developed a replication methodology running each query across 50 frontier-class models with multiple stochastic replicates at controlled temperatures, isolating stable structure from single-response variance over 260+ concepts and 80 brain regions.
- Architected a multi-provider LLM API client in Python spanning eight inference backends (OpenRouter, Hugging Face, Together AI, Replicate, Mistral, Amazon Bedrock), with resilient retry logic, jittered backoff, and rate-limit recovery.
- Built a parallelized batch-execution pipeline (Streamlit, concurrent.futures) with reproducible run provenance, logging seeds, temperatures, and prompts so any result can be traced and replayed.
- Engineered structured-output prompting and parsing to convert heterogeneous model responses into machine-readable activation vectors, including stripping reasoning traces from thinking models before parsing, with automated fallback handling for malformed or empty returns.
- Showed that LLMs encode human concepts in a low-dimensional geometry converging on established large-scale brain networks, with concept sub-groups mapping distinctively onto the canonical triple-network organization (default-mode, frontoparietal control, salience) and cross-dataset comparison yielding convergence with human datasets; results accepted as a first-author poster abstract at FENS Forum 2026.

Publications & Presentations

XCAVATE: A Cross-Model Platform for Mapping Concepts onto the Human Brain — FENS Forum 2026

- **W. Lin**, T. Berjaga i Buisan, H. Nidavolu, A.H. Lin, I. Olivarez, G. Leith, I. Acero i Pousa, A.Z. Yang, I. Oane, I. Mindruta, G. Deco, J. Tang — Poster abstract accepted, Federation of European Neuroscience Societies, Barcelona, Spain.
- Co-author on manuscripts in preparation for Nature Human Behaviour and Nature Machine Intelligence; first author on a manuscript in preparation for Nature Protocols. Research presented at the University of California, Santa Cruz.

Projects

XCAVATE Viewer | *React, FastAPI, PyVista, NiBabel, NumPy, Matplotlib, Pillow* — 2026

- Built a full-stack research tool that turns an 80-region brain activation vector into a composed six-panel figure on demand: a React frontend queries a FastAPI backend running a PyVista pipeline, with Pydantic request validation, typed error responses, and a health check reporting missing atlas files.
- Wrote the rendering engine: maps each vector onto 32k cortical surface vertices per hemisphere, mirroring index order for the right hemisphere, then masks subcortical regions out of the surface so they composite as a separate heatmap beneath a 3×2 grid of lateral, medial, and flattened views, using custom colormaps and per-view orthographic cameras.

Leadership & Involvement

Campus Ambassador — Fall 2026
Velocity, University of Waterloo — *Waterloo, ON*

- Promoting Velocity programming across campus, organizing community events, and partnering with student-led organizations at Waterloo's startup incubator (500+ companies launched since 2008).

Member | *UW Computer Science, Quant, Data Science, and Poker Clubs*

Certifications & Awards

- 1st Place (Healthcare Track) — UTMIST × WAT.ai AI Hackathon, Sept. 2026
- Level 10 Piano Certification — Royal Conservatory of Music
- 1st Degree Black Belt — Gima-ha Shotokan-ryu Karate Association
- 2nd Place (Silver Medal), Kumite (Sparring), Blue-Brown Belt Division — Steveston Invitational Karate Tournament, Mar. 2025

Technical Skills

Languages & Web: Python, JavaScript (JSX), React, Vite, FastAPI, REST API design, Pydantic, Streamlit
Scientific Computing: NumPy, pandas, Matplotlib, PyVista, NiBabel, Pillow, openpyxl
LLM Engineering: Multi-provider inference APIs (eight backends); structured-output prompting and parsing; reasoning-model trace handling; temperature/seed control for reproducibility; resilient retry and connection pooling
Research: Cross-model replication design, statistical validation, experiment provenance and diagnostics, literature review across ML, neuroscience, and psychology