Mathias Babin, Ph.D. Candidate

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Research Interest

- Broadly, my research interests lie in Generative AI, with a focus on procedural content generation for video games. My work emphasizes the use of hybrid ML approaches to applications in level generation, game balance, optimization, and anti-cheat systems. These works employ a diverse range of methods, including supervised and unsupervised learning, reinforcement learning, and constraint satisfaction algorithms.
  My future research goals include contributions to neural rendering and AI-driven testing and evaluation.

Employment History

2023 – 2024 · · · · **Lecturer.** CS4482 Game Programming, UWO, Department of Computer Science.

2018 – 2024 · · · · **Teaching Assistant.** CS1026, CS2209, CS3388, CS4482, CS4483, UWO, Department of Computer Science.

2023 – 2024 · · · · **Software Developer.** UWO, Department of Education. Software developer and consultant on the development of an AI-based curriculum for students K-12.

Internship Nomad XR. R&D at Nomad XR. Developed VR environments featuring procedurally generated worlds. Hardware: Kat-VR treadmill and Meta Quest Pro headset.

2019 – 2023 · · · · **Software Developer.** UWO, Contract work for the faculty of Psychiatry, required the development of a VR environment in which patients suffering from PTSD would experience a neural-feedback loop driven by real time EEG data influencing aspects of the virtual environment. Hardware: Muse Mind Monitor, Oculus Quest Pro.

2020 – 2021 · · · · **Software Developer.** UWO, Department of Education. Contract work for the development of a VR environment to serve as a controlled environment for the study autism in children.

2018 – 2019 · · · · **Software Developer.** UWO, Department of Health Science. Contract work for faculty of the Health Science department called for the development of a VR simulation for several car crash scenarios. The application required synchronization with a motorized platform via operation commands sent over TCP. Hardware: HTC Vive support, Mikrolar R-Series rotopod.

Software Developer. UWO, Department of Music. Contract work for the faculty of Music, required the development of a VR fantasy environment in which players interacted with music-inspired game elements. Hardware: Oculus Go support.

Education

2020 – Present · · · · **Ph.D. Computer Science, UWO** Specialization in AI.

2018 – 2020 · · · · **M.Sc. Computer Science, UWO** Specialization in AI
Thesis title: *A Hybrid Approach to Procedural Dungeon Generation.*

2014 – 2018 · · · · **Bachelor of Science, UWO** Honours Specialization in Computer Science

Research Publications

Journal Articles

1. G. Chen, Z. Bao, M. Babin, and P. Frewen, "Virtual reality and neuromodulation in the induction of out-of-body experience (vr-niobe): A proof-of-concept new paradigm for psychological and neuroscientific study of an altered state of consciousness," *Psychology of Consciousness: Theory, Research, and Practice. Advance online publication*, 2024. DOI: https://doi.org/10.1037/cns0000385.
2. M. J. Lukacs, M. Babin, J. P. Dickey, C. W. J. Melling, and D. M. Walton, "Development and tolerability of a novel virtual- and proprioception-based car crash simulator as a new research tool in motor vehicle trauma research," *Frontiers in Virtual Reality*, vol. 4, 2023, ISSN: 2673-4192. DOI: 10.3389/frvir.2023.891423.

Conference Proceedings

1. M. Babin and M. Katchabaw, "Combating computer vision-based aim assist tools in competitive online games," in *Entertainment Computing – ICEC 2023*, P. Ciancarini, A. Di Iorio, H. Hlavacs, and F. Poggi, Eds., Singapore: Springer Nature Singapore, 2023, pp. 290–305, ISBN: 978-981-99-8248-6.
2. M. Babin and M. Katchabaw, "Leveraging reinforcement learning and wavefunctioncollapse for improved procedural level generation," in *Proceedings of the 16th International Conference on the Foundations of Digital Games*, ser. FDG '21, Montreal, QC, Canada: Association for Computing Machinery, 2021, ISBN: 9781450384223. DOI: 10.1145/3472538.3472541.

Theses/Dissertations

1. M. Babin, "Hybrid approaches to procedural content generation for game design, production, and security (working title)," 2025.
2. M. J. Lukacs, "Creation of a virtual interface for stress-trauma investigations through open world navigation: An exploration of tolerability and physiological reactions," M. Babin listed as coauthor of Chapter 3, 2021. URL: https://ir.lib.uwo.ca/etd/8004/.
3. M. Babin, "A hybrid approach to procedural dungeon generation," 2020. URL: https://ir.lib.uwo.ca/etd/7129/.

Submitted Works

1. M. Babin and M. Katchabaw, "Game balance through procedural content generation," Submitted February 2025 to IEEE GEM 2025.
2. M. Babin and M. Katchabaw, "Wave function approximation: Performant level generation for games," Submitted January 2025 to FDG 25.

Miscellaneous Experience

Presentations

2024 · · · ·
- **AI Education Symposium**, UWO, Ray John Jr from the Oneida nation along with colleagues Mathias Babin and Jodie Williams, shared work exploring applications of AI, and how this can help advance understandings of Indigenous knowledge systems.
- **UWORCS Conference**, UWO, First Place Winner in AI track.

2023 · · · ·
- **ICEC Conference**, ICEC Conference, Bologna Italy.

Miscellaneous Experience (continued)

- **UWORCS Conference**, UWO, First Place Winner in AI track.

2021 · · · ·

- **FDG Conference**, FDG Conference, Virtual.
- **UWORCS Conference**, UWO.

Awards and Achievements

2023 · · · · **NSERC L2M**, UWO.

2018 – 2023 · · · · **Ontario Graduate Scholarship**, UWO.

2014 · · · · **Merit Award**, The Western Scholarship of Distinction.

2014 – 2018 · · · · **Dean's Honour Roll**, UWO.

Projects

2024 · · · · **LoJam 2024 award winning project (Best Gameplay): Swarmancer**

2023 · · · · **LoJam 2023 award winning project (3rd place judges pick, 1st place player's pick): Dark Harvest**

2022 · · · · **Hack Western 9 Entry: genee**. Hack Western 9 winning project. Project and awards listed on Devpost.

- **Distributed Implementation of Evolutionary Strategies using gRPC**. This work presents a distributed implementation of the evolutionary strategies optimization algorithm. Due to its high degree of parallelizability, this algorithm's core functionality can be easily distributed across multiple remote workers. In order to maintain simple service definitions as well as support for multiple programming languages such as Golang, C++, and Python, communication between nodes is conducted via the gRPC framework.

2018 · · · · **Asynchronous Network Simulator**. A project which allowed programmers to supply their own C# algorithms to asynchronous network topologies. Code could be dynamically compiled and interact with the simulator at runtime via the .NET framework.

2017 · · · · **Step Block Stereo**. A project developed for CS4436, Step Block Stereo was a music based puzzle game which tied the movement of various puzzle elements to the rhythms of an instrument. As of Winter 2018, it was requested that the game be presented on behalf of the Computer Science department at an event held by Libro Credit Union.

Skills

Coding — Java, Python, C/C++/C#, gRPC, LaTeX

Framework/Packages — Pytorch, Tensorflow, CUDA, Pandas, Numpy

Environments — Unity, Unreal Engine, Visual Studio, Rider, PyCharm, Anaconda, Jupyter

Misc. — Academic research (Deep Learning, Reinforcement Learning, Procedural Generation, Generative AI), teaching, project management