Marcus Hedlund

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Education

University of Pennsylvania — Philadelphia, PA
Bachelor of Science in Engineering in Artificial Intelligence; GPA: 3.98/4.00 — *May 2027*
Master of Science in Engineering in Computer and Information Science; GPA: 4.00/4.00 — *May 2027*

The Blake School — Minneapolis, MN
High School Diploma; GPA: 3.98/4.00; ACT: 36 — *June 2023*

- Sarah Armfield-Hill Award in Mathematics; Cum Laude Society; U.S. Presidential Scholar Candidate

Work Experience

Undergraduate Researcher — Philadelphia, PA
University of Pennsylvania (with Prof. Chris Callison-Burch) — *May 2025 – Present*

- Architected multi-agent simulation in Godot with FastAPI Python backend for LLM-driven autonomous agents
- Designed scalable systems supporting 10+ complex agent actions with robust state management and event-driven architecture for synchronized agent-object interactions
- Developed debugging and visualization tools, as well as extensible action schemas and natural language parsing, enabling both flexible and real-time agent behaviors

Projects

Cloud-based Search Engine | *Java, AWS (EC2, DynamoDB, S3)* — Nov. 2024 – Dec. 2024

- Engineered distributed search engine processing 150,000+ web pages with team of 4, implementing crawler, Key-Value Store (KVS), analytics engine, ranker, and frontend
- Streamlined web page processing using PageRank, inverted index, stemming, and domain deduplication; leveraged DynamoDB and in-memory caching of IDF/PageRank to reduce query latency from 60s to less than 2s
- Resolved real-world web data challenges including malformed HTML, encoding issues, and adversarial content through robust parsing and validation

Mini Minecraft — 3D World Engine | *C++/OpenGL/Qt* — Mar 2025 – May 2025

- Developed a scalable, Minecraft-inspired 3D engine with efficient chunk-based voxel rendering and multithreaded procedural world generation, supporting 100+ concurrent chunks and seamless infinite world expansion
- Engineered high-performance rendering with advanced optimizations, including face culling, interleaved VBOs for 16×256×16 block chunks, and 3D Perlin noise for procedural cave generation and biome-specific asset placement
- Implemented dynamic effects including water waves, distance fog, and day/night cycles using GLSL shaders; built tools for OBJ mesh voxelization and image-based world editing

PennOS — UNIX-like Operating System | *C* — Mar 2025 – May 2025

- Designed and implemented FAT-based file system supporting basic file operations, metadata management, efficient block allocation, global file system table and modular abstraction layers
- Led integration of kernel, scheduler, and shell subsystems, resolving complex concurrency issues and race conditions for seamless functionality

Music Exploration Web Application | *JavaScript, PostgreSQL, React* — Sept. 2024 – Dec. 2024

- Created full-stack music analytics app integrating multiple datasets for audio feature visualizations, chart tracking, music evolution analytics, and artist recommendations

Leadership Experience

UPGRADE Game Development | *Developer* — Sept. 2023 – Present

- Coordinated game jams and speaker events with industry leaders including Mobius Digital

SIGGRAPH | *Member* — Sept. 2023 – Present

- Led weekly project showcases and collaborative code reviews providing technical feedback on projects spanning the graphics pipeline

Additional Information

Citizenship: Dual Swedish-American
Swiss Semester: Skied, wet-gorged, ice-climbed, and studied abroad in Zermatt, Switzerland
Other: Avid hockey player, high school varsity soccer captain, and dedicated pianist