Marcus Hedlund

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Education

University of Pennsylvania Philadelphia, PA

Master of Science in Engineering in Computer and Information Science; GPA: 4.00/4.00 *May 2027*

Bachelor of Science in Engineering in Artificial Intelligence; GPA: 3.99/4.00 *May 2027*

Relevant Coursework: Trustworthy Machine Learning; Deep Learning; Big Data Analytics; GPU Programming & Architecture; Operating Systems Design & Implementation; Internet & Web Systems; Introduction to Algorithms

Experience

Undergraduate AI Researcher Philadelphia, PA

University of Pennsylvania (Prof. Chris Callison-Burch) *May 2025 – August 2025*

- Built multi-agent simulation framework with Python/FastAPI backend and Godot visualization frontend; implemented REST API endpoints for agent state updates and environment interactions.
- Designed extendable YAML-based configuration system for agent personas and prompts, enabling rapid iteration; developed pytest integration tests for concurrent multi-agent scenarios.

Projects

OpenGJK-GPU | *C++, CUDA, CMake, OpenGL* Nov. 2025 – Dec. 2025

- Implemented GPU-accelerated GJK and EPA collision detection in CUDA for real-time graphics workloads; designed warp-cooperative kernels using warp-level primitives achieving up to 37× speedup over CPU baseline.
- Designed robust C++ API with automatic GPU memory management and efficient host-device transfers; developed OpenGL visualizer simulating 20,000 polytopes at 60 FPS using spatial grid subdivision for collision culling.
- Optimized memory access patterns and kernel divergence through profiling with NVIDIA Nsight Compute; reduced bottlenecks and supported both 32-bit and 64-bit precision for flexible performance/accuracy tradeoffs.

PennOS | *C* Mar 2025 – May 2025

- Engineered a UNIX-like operating system with priority-based scheduler, user-level threading, signal handling, and shell supporting job control, I/O redirection, and built-in commands (cat, ls, cp, rm, chmod, ps, nice).
- Designed and implemented FAT-style file system with dynamic block-level storage management, file descriptor abstraction, and complete POSIX-like API (open, read, write, lseek, close, unlink).

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+ active chunks and seamless infinite world expansion.
- Optimized rendering via face culling and interleaved VBO layouts; built OBJ mesh voxelization and image-based world editing tools, and shader-driven effects (water waves, distance fog, day/night cycles).

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

- Built distributed web crawler and indexing pipeline processing 150k+ pages; implemented TF-IDF scoring, reverse index generation, and iterative PageRank computation using graph algorithms across multiple worker nodes.
- Optimized query latency by migrating to AWS DynamoDB and implementing in-memory caching of frequently accessed IDFs and PageRank values, reducing average query response time from >1 minute to ∼1–2 seconds.
- Debugged complex distributed system issues including worker crashes, memory leaks, and data consistency problems; used systematic logging and profiling to identify bottlenecks in the indexing and ranking pipeline.

Extracurriculars

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

- Organized game jams and speaker events (e.g., Mobius Digital), coordinating logistics and developer participation.

SIGGRAPH | *Project Team* Sept. 2023 – Present

- Led weekly project showcases and code reviews for student graphics projects across the rendering pipeline.

Technical Skills

Languages: C/C++, Python, Java, SQL (PostgreSQL), JavaScript, HTML/CSS
Tools/Platforms: CUDA, Git, CMake, Valgrind, AWS (EC2, DynamoDB, S3), OpenGL
Data/Libraries: NumPy, pandas, Matplotlib, PyTorch, scikit-learn