Nils Matteson

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Education

University of Wisconsin–Madison Madison, WI

B.S. Data Science, Minor in Computer Science *Expected May 2026*

- **Relevant Coursework**: Artificial Intelligence (CS 540), Machine Organization (CS 354), Data Structures & Algorithms (CS 400), Discrete Mathematics (MATH 240), Linear Algebra (MATH 340), Statistical Modeling (STAT 340).

Technical Skills

Languages: Python, Rust, Go, C++, TypeScript/JavaScript, SQL
ML & AI: PyTorch, Transformers, LLMs, Stable Diffusion, Scikit-learn, Hugging Face, OpenCV
Systems & Cloud: Distributed Systems, gRPC, Docker, Kubernetes, AWS, GCP, Redis, Kafka, PostgreSQL
Web & Graphics: React, Next.js, WebSockets, Three.js, WebGL, GLSL Shaders

Selected Projects

Sentinel: Distributed Log Streaming Engine *Go, gRPC, Protobuf, LSM Trees, Raft*

High-throughput distributed message queue architected from scratch (5,600+ lines).

- Engineered a custom LSM-tree storage engine with skip list memtable, achieving **1.7M writes/sec** and **3.9M reads/sec** on commodity hardware with CRC32-verified SSTables and crash-safe WAL.
- Implemented Raft-inspired consensus for leader election and log replication, featuring randomized election timeouts, AppendEntries RPC with conflict detection, and majority-based commit tracking.
- Built gRPC streaming API with Protobuf, supporting Kafka-style topic/partition model, consumer groups with round-robin rebalancing, and hash/round-robin partitioners.
- Integrated Prometheus-compatible metrics endpoint tracking throughput, latency histograms, and partition lag across 21 passing unit tests.

Synapse: Real-time Collaborative Whiteboard *Rust, WebAssembly, WebSockets, Redis, React*

Conflict-free collaborative workspace supporting 50+ concurrent users with sub-100ms sync.

- Built a high-performance WebSocket server in Rust (Actix) with CRDT-based state synchronization (Yjs), enabling lock-free concurrent editing across distributed clients.
- Optimized client rendering via WebAssembly and HTML5 Canvas, maintaining **60 FPS** with 10,000+ vector objects on screen.
- Architected horizontal scaling using Redis Pub/Sub for ephemeral state broadcasting across WebSocket gateway nodes.

Aura: 3D Audio-Reactive AI Universe *Three.js, WebGL, PyTorch, Stable Diffusion, Web Audio*

Immersive generative art experience syncing 3D visuals with live audio input.

- Developed real-time audio reactivity engine using Web Audio API FFT analysis, mapping frequency bands to GLSL shader uniforms for dynamic geometry manipulation at **60+ FPS**.
- Integrated OpenAI Whisper for live lyric transcription and Stable Diffusion for on-the-fly texture generation based on semantic song context.
- Authored custom ray-marching fragment shaders for volumetric lighting effects, optimizing GPU utilization for smooth browser performance.

Madison Metro Bus ETA System *Python, FastAPI, Docker, PostgreSQL, LSTM, GCP*

End-to-end ML pipeline predicting bus arrival times with higher accuracy than official schedules.

- Architected data ingestion pipeline consuming GTFS-RT streams, processing **1M+ monthly positions** into a PostGIS-enabled feature store for spatial queries.
- Trained LSTM and Transformer sequence models, reducing arrival time prediction error (MAE) by **25%** vs. static timetables.
- Containerized inference API with Docker, deployed via GitHub Actions CI/CD to cloud VPS with **99.9% uptime**.