

# Matt McManus

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**Citizenship:** U.S Citizen | **Location:** New York, NY

## SUMMARY

Engineer with research grounding in scientific ML (MIT thesis on physics-informed neural ODEs; mechanistic interpretability/RL projects) and industry experience at Two Sigma (leakage-safe evaluation, decorrelation, OOS IC/IR). Currently leverage structured and unstructured data with LLMs to pursue macroeconomic alpha—building evaluation/calibration pipelines and scalable FastAPI/Kubernetes services.

## EDUCATION

### Massachusetts Institute of Technology

Cambridge, MA

*Master of Engineering in Computer Science, GPA: 5.0/5.0*

*Aug. 2023 - Jun. 2024*

- Thesis: Physics-informed neural ODEs for inertial navigation systems with Prof. Alan Edelman (Julia Lab)

*Bachelor of Science in Mathematics & Computer Science*

*Aug. 2019 - Feb. 2024*

- GRADUATE/RESEARCH: Modeling with ML, LLMs & Beyond, Multi-Agent Comm., Scientific ML, Stat. Learning Theory
- MATH/THEORY: Probability, Linear Algebra, Optimization, Algorithms, Statistics
- Activities: MIT Varsity Squash, MIT Pokerbots President, MIT Bitcoin Club, HKN Tutor

## EXPERIENCE

### Bridgewater Associates — AIA Labs

New York, NY

*Engineer*

*Sept. 2024 – Present*

- Enforced temporal isolation and leakage controls in **LLM evaluation** with dispersion signals and **calibrated probability** outputs.
- Operated a parallel **FastAPI** service on **K8s** (autoscaling, process + I/O pools) for **3–4x** higher evaluation throughput.
- Improved data integrity via recency gates + source allowlists, reducing investigation time by **50%** and ensuring repeatability.

*Investment Engineer Intern*

*Jun. 2023 - Aug. 2023*

- Developed data models and **algorithmic systems** to solve complex investment problems
- Designed **statistical instruments** for macroeconomic trend analysis, improving signal quality across 10+ markets

### Two Sigma

New York, NY

*Quantitative Researcher (Part-time)*

*Jan. 2024 – Jun. 2024*

- Developed **cross-sectional alphas**; factor-neutral (beta/sector/size) and validated via rolling **OOS rank IC and IR**.
- Designed feature- and learner-level **decorrelation** (orthogonalization, column subsampling, correlation-penalized loss).
- Built a **leakage-safe** walk-forward pipeline with rolling normalization, liquidity-weighted scoring, and reproducible backtests/ablations.

### MIT CSAIL — Julia Lab (Advisor: Alan Edelman)

Cambridge, MA

*Graduate Researcher — Scientific ML & INS*

*Sep. 2023 – Jun. 2024*

- Built Julia **physics-informed neural ODEs** for strapdown INS and cut 3D RMSE by **63%** vs tuned EKF.
- Developed IMU simulation harness enabling **100+** **walk-forward tests** daily with automated robustness checks.
- Open-sourced reproducible pipelines with CI, adopted by Leidos for navigation-grade sensor validation.

### MIT CSAIL — ALFA (Advisor: Una-May O'Reilly)

Cambridge, MA

*Undergraduate Researcher — LLMs for Cyber Defense*

*Sep. 2022 – Jun. 2023*

- Built **graph-based cyber-defense simulator**; used GPT-3 for anomaly detection and attack pathing.
- Ran controlled studies across 50+ network topologies; achieved **2x faster** decision latency vs RL baselines.
- Prototyped **neuro-symbolic** layers for interpretability; saved resources by pivoting after rigorous A/B testing.

## SELECTED RESEARCH

### How Do Transformers “Do” Math? Interpretability for Linear Regression

*MIT, 2024*

*Course Research Project / Poster; Mechanistic Interpretability, Probing & Interventions*

- Showed transformers encode/use task intermediates (slope  $w$ ) via features; tied encoding to performance via probing
- Provided causal evidence via reverse probes + interventions (forcing  $w \rightarrow w'$  predictably shifts outputs)

### Low-Complexity Interpolation for Deep Neural Networks

*MIT, 2022*

*Course Research Project / Unpublished Manuscript*

- Developed training scheme for *low-complexity* interpolating solutions; tested against ERM baselines.
- Achieved lower test error and smaller weight norms; connected gains to double-descent behavior.

*Full research portfolio: mmmcmanus1.github.io/research/*

## TECHNICAL SKILLS

**ML/AI:** PyTorch · TensorFlow · Hugging Face · Transformers/LLMs · Reinforcement Learning · Scientific ML · XGBoost

**Programming:** Python · Julia · C++ · Scala · Java · Go · SQL/Spark · JavaScript · R

**Infrastructure:** AWS · Docker · Kubernetes · Git · CI/CD · Distributed Systems · PostgreSQL

**Finance:** Quantitative Research · Factor Models · Backtesting · Risk Management

## LEADERSHIP & ACHIEVEMENTS

**MIT Pokerbots President:** Led Harvard-MIT ML poker competition (**250+** students), secured **\$100k+** sponsorships

**MIT Varsity Squash:** Achieved National Team Ranking of **16th** in U.S. (2023-2024), 4-year starter

**Honors:** MIT Pokerbots 1st Place (Freshman) • HackMIT Award Winner (Sophomore)