Natalie Buchbinder

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EDUCATION:

Georgia Institute of Technology, *M.S. in Computer Science* (on leave)
Yeshiva University, Stern College, New York, NY *B.A. in Computer Science, January 2025* | ***Overall GPA:*** *3.7*

SKILLS:

Languages: Python, C/C++, Java, Kotlin, SQL, KQL, awk, Spark
ML & Modeling: PyTorch, TensorFlow, Scikit-Learn, scikit-survival, LLMs, RAG, Prompt Engineering, AI Agents, ProgPy, Particle Filtering, Bayesian State Estimation, Monte Carlo Methods, NumPy, SciPy, Pandas
Systems & Infra: FastAPI, Docker, Render, Cloudflare R2 (S3-compatible), SQLite, ChromaDB, Git, Linux, React, Django

EXPERIENCE:

Kaful, Founder & ML Engineer, January 2026 - Present

- Founded Kaful, a **physics grounded digital twin pipeline for predictive maintenance and remaining useful life** (RUL) forecasting in settings where historical failure data is limited or absent.
- Built a seven stage **agentic pipeline (RAG + LLM** extraction) that parses OEM manuals, extracts component specifications, generates physics based degradation models, and produces component level RUL forecasts with calibrated uncertainty via forward Monte Carlo
- Generated and published digital twin demos for four real machines directly from raw OEM PDFs (CNC spindle, air compressor, LPCVD semiconductor furnace, and Eversys espresso machine). Presented related work at IWSM 2026.

Predictive Maintenance Researcher, February 2025 - January 2026
École Polytechnique Fédérale de Lausanne (EPFL) & Yeshiva University. In collaboration with an industry partner.

- Built and evaluated survival / RUL models for equipment failure prediction - CoxPH, Random Survival Forest, Gradient Boosting Survival Analysis, and DeepSurv - on real world time series sensor data under right censoring (Harrell's C, Uno's C, time dependent AUC, Integrated Brier Score).
- Translated MATLAB predictive maintenance workflows into highly maintainable Python production code, implementing end to end reliability, degradation modeling, and deep learning for RUL.

PROJECTS:

Kaful Streaming Tool / Wear Prognostics for CNC Machines - [GitHub]

- Built and shipped a live CNC tool wear prognostics platform where a particle filter infers hidden flank wear from force, vibration, and acoustic sensor features, achieving a **5.3 µm RMSE** with calibrated **90% uncertainty intervals** while forecasting cuts to failure via Monte Carlo simulation.
- Shipped the complete production pipeline, including streaming telemetry ingestion, feature extraction, Bayesian state estimation, FastAPI inference services, S3 compatible object storage, and a live monitoring dashboard deployed on Render.
- Traces a cross tool generalization failure to the wear → signal observation map, killing a planned milestone on that evidence and shipping the fixes that worked: a more transferable feature (cross tool RMSE **33 to 21 µm**) and a few shot calibration (~10 µm error from ~20 measurements).
- Built a two tier validation harness that caught and corrected interval overconfidence (**coverage from 0.46 to 0.90**).

Battery Remaining Useful Life CNN - [GitHub]

- Built a 5-block 2D CNN in PyTorch to regress lithium-ion battery RUL from interpolated discharge curves converted into 3 channel image style inputs.
- Achieved R^2 0.76 on held out test batteries, with RMSE 148 cycles and MAE 87 cycles; fixed gradient explosion using gradient clipping.