Alexander Baumgartner

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Education

University of Chicago Sep 2022 - Jun 2026

BS in Computer Science Spec. ML; BS in Data Science (GPA: 3.8 / 4) *Chicago, IL*

- **Previous Coursework:** Intro to CS(I-II), Intro to DS(I-II), Systems Programming (I-II), Discrete Math, Theory of Algorithms, Mathematical Foundations of ML, Math for DS(I-III), SSI: Spatial Analysis(I-III), Data Vis. and Comm., Intro to Neural Networks, ML for computer systems, Models in Data Science, Quantum Computation

Experience

Scout Jun 2024 - Dec 2024

Software Engineer *Chicago, IL*

- Architected and implemented a patent-pending configurable clustering algorithm for dataset consolidation and model optimization, generating industry-based composite data products. Enhanced usability with runtime-configurable parameters and a fine-tuned neural network for cluster naming and searching. Visualized clusters in 3d post PCA. (pandas, NumPy, scikit-learn, PyTorch, BERT, UMAP, HDBSCAN, gensim, nltk, LDA, plotly)
- Implemented symmetric encryption and deterministic tokenization solutions, significantly enhancing data security, privacy, and regulatory compliance of any data passed through. (Python, PyCryptodome, MongoDB, Firebase, AWS)
- Presented product vision and technical architecture to C-level executives, highlighting the value of Scout's data security and commercialization strategies to drive business development and compliance.

University of Chicago Jan 2024 – Present

Student Grader for Data 118/119/120/227 *Chicago, IL*

- Collaborated with professors and TAs to optimize course content and teaching, leveraging insights gained from grading to address student weaknesses and improve overall learning outcomes across multiple data science courses.
- Efficiently evaluate and provide constructive feedback on assignments spanning topics from machine learning, data visualization and communication, project design and best-practice programming.

Projects

Network Anomaly Detection with BitNet | *Python, PyTorch, scikit-learn*

- Developed a hardware-efficient IDS, leveraging BitNet's quantization to minimize matrix multiplications.
- Built and trained a custom regression model on large-scale packet traces to detect intrusion attempts.
- Implemented performance tracking (psutil, pyRAPL) to measure CPU usage and energy consumption, comparing matrix-free vs. standard neural models.

Gerrymandering-Safe Redistricting with Machine Learning | *Python, MCMC, Graph Theory, Geospatial Data*

- Developed a Markov chain Monte Carlo (MCMC) algorithm for redistricting that balances fairness metrics including Voting Rights Act compliance, compactness, community preservation, and population parity.
- Leveraged a graph-based approach (via `networkx`) and geospatial operations (`shapely`) to ensure district contiguity, modeling boundaries as "graph cuts" for efficient exploration of redistricting plans.
- Integrated incremental scoring updates and a multi-phase descent strategy, reducing iteration times from 10 seconds to under 1 second on standard hardware.

Quantum Machine Learning Projects | *Qiskit, PyTorch, Python*

- Developed hybrid quantum–classical models for binary classification (*make_moons*) and time-series forecasting (Google stock prices), integrating parameterized Qiskit circuits with PyTorch training loops.
- Used feature re-uploading to map classical data onto quantum circuits, applying gradient-based optimization for circuit parameters and final predictions.
- Implemented fundamental quantum algorithms (Grover's Search, Deutsch–Jozsa, coin-flipper, teleportation) to deepen practical familiarity with core quantum computing concepts.

Technical Skills

Languages: Python, C, SQL, R, HTML, CSS, JavaScript
Technologies: pandas, NumPy, scikit-learn, matplotlib, Altair, GeoDa, Tableau, PyTorch, Django, Docker, Git, React.js, Airbyte, dbt, Airflow, UMAP, NLTK, gensim, spaCy, tqdm, HDBSCAN, BERT, LDA, AWS, MongoDB, PostGreSQL
Concepts: Virtual & Cache Memory, Encryption/Decryption, Tokenization, Artificial Intelligence, Machine Learning, Neural Networks, Natural Language Processing, REST/GraphQL API, Agile, Data Engineering, Cloud Computing, Concurrency