Alexander Kim

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Education

Hamilton College, Clinton, NY — Aug 2021–May 2025
B.A. Mathematics (Minor: Music) — GPA 3.5 / 4.0
Relevant Coursework

- **Computer Science:** Deep Learning; Data Structures & Algorithms; Electronics & Computers; Operating Systems Engineering (MIT ocw)
- **Mathematics & Statistics:** Linear Algebra II; Graph Theory; Modern Algebra; Real Analysis; Multivariable Calculus; Linear Optimization; Senior Seminar in Statistics; Statistical Modeling & Applications

Research Experience

- **Emerson Summer Research Fellow** — May 2024–Aug 2024
  Hamilton College, Clinton NY — *Advisor: Prof. Charlotte Botha PhD (Music ML/DL)*

  My fellowship investigates how audio signal processing and different deep learning/ machine learning methods can provide real-time pedagogical and clinical feedback for vocalists. The project combines FFT-based feature extraction, CNN/SVM modelling, and full-stack deployment to a campus-wide musical user base.

  Training and Full-Stack Application Inference Pipelines. Designed a FastAPI+React stack that streams microphone input, applies FFT/Mel filterbanks, and delivers register diagnostics in under 150 ms; the Docker deployment serving 2000+ users.
  Model Development and Interpretability. Curated a 14000+ image dataset and trained custom CNN (96% accuracy) and RBF-SVM (94% accuracy), using PyTorch and scikit-learn to classify vocal audio samples based on singing technique.
  Research Findings. First-authored preprint arXiv:2505.11378 (pending submission) detailing cross-validated performance studies on sliding window and DL/ML architectures.

- **Research Intern** — Jun 2022–Aug 2023
  Boston Children's Hospital / Harvard Medical School — *PI: Dr. Ata Kiapour PhD*

  As a researcher in the Musculoskeletal Informatics Group, my work combined graph-based machine learning, clinical NLP, advanced imaging segmentation, and surgical simulation to enhance decision-making for pediatric orthopedic procedures.

  Mesh-Repair and Surgical Simulation Algorithms. Implemented KNN for predictive smoothing with hole-filling in scikit-learn and MeshLab, salvaging 10% of corrupted pelvic meshes. Developed Python simulation library that cut PAO & VDRO pre-operative planning time by 20%
  Multimodal Cohort Training. Extracted NLP features from 2500+ EHR notes. Annotated clinical notes from the legacy system to improve upon a, 20-year ACL dataset; findings

on concomitant meniscal and ligament injuries published in *Am. J. Sports Med 2023.* (co-author). Co-authored weakly-supervised clinical NER manuscript published in *ACL Anthology BioNLP 2023.*

Segmentation Pipelines and Training. Engineered 100+ MRI and CT based segmentation data for VirtualHip segmentation pipline improving surgical planning time by 20%.

Research Focus Areas

Bioinformatics, Clinical NLP, Multimodal Health Data, Computer Vision

Peer-Reviewed Publications

1. Suresh, S. *et al.* (2023) **Kim, A.** (2023). Intermediate Domain Finetuning for Weakly Supervised Domain-Adaptive Clinical NER. *ACL Anthology BioNLP.* `https://aclanthology.org/2023.bionlp-1.29/`

2. Pruneski, J. *et al.* **Kim, A.** (2023). Concomitant Meniscal / Ligament Injuries Associated with Pediatric ACL Surgery. *Am. J. Sports Med.* `https://journals.sagepub.com/doi/full/10.1177/03635465231205556`

3. Salt, M. D., **Kim, A. (second author)**, Flaherty, M. R., *et al.* (2020). Distracted-driving Laws and Teenage Crash Fatalities. *Pediatrics* 145(6). `https://doi.org/10.1542/peds.2019-3621`

Preprint / Under Review

1. **Kim, A.**, Botha, C. (2024). Machine-Learning Approaches to Vocal-Register Classification in Contemporary Male Pop Music. *arXiv:2505.11378.* `https://arxiv.org/abs/2505.11378`

Honors & Awards

- Emerson Summer Research Fellowship, Hamilton College (2024)
- Dean's List

Software Projects

SOFIA — Offline LLM Agent (14 Github Stars) Feb 2025–Jul 2025

- Engineered middleware and OmniParser OCR layer, enabling tool use, MCP, and computer use.
- Built local automation loop (OpenAI/Ollama), integrating Gmail and Google Calendar APIs.

tensorkit-learn — Custom ML Library Jan 2025–Jul 2025

- Implemented MLP, SVM, and GLM modules in C++ / Python with tensor ops and DataLoader.
- Wrote 32 unit tests plus shell install scripts for reproducible local setup.

braindump — Self-hosted Tech Blog Mar 2025

- Deployed full-stack blog on an NVIDA Jetson (Docker, Postgres); migrated data from Supabase.

- Delivered front-end (Vanilla JS) and local Postgres db with VPN for private access.

Industry Experience

- **Epic Systems**, Madison, WI
  Project Manager (August 2025 – Present)
  - Lead cross-functional technical and operational initiatives in healthcare software infrastructure.
  - Supervised and consulted on system implementations via agile project management, stakeholder coordination, and product lifecycle oversight in clinical data systems.
- **tmc**, Boston, MA
  Software Engineering Intern (March 2025 – August 2025)
  - Architected cross-platform mobile invoicing MVP using React Native and TypeScript.
  - Implemented huggingface OCR and deployed via scalable Sanic REST API in Docker. Built and documented end-to-end OCR model testing pipelines in Jupyter Notebook.
  - Automated receipt parsing and integrated Memgraph and TigerBeetle for desktop MVP database pipeline.

Technical Skills

Languages: Python, C/C++, SQL, TypeScript, Java, R, LaTeX
Libraries: PyTorch, scikit-learn, pandas, NumPy, OpenCV, Matplotlib
Frameworks: React, Node.js, Flask, Sanic, MCP, CUDA
Tools: Git, Docker, Linux, Google Cloud Platform, Google Colab

References

- **Dr. Ata Kiapour PhD**
  Principal Investigator, Musculoskeletal Informatics Group
  Boston Children's Hospital / Harvard Medical School
  `Ata.Kiapour@childrens.harvard.edu`
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- **Professor Sally Cockburn PhD**
  Mathematics Academic Advisor
  Samuel F. Pratt Professor of Mathematics & Statistics
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- **Professor Saber Ahmed PhD**
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- **Professor Shawn Chen PhD**
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- **Professor Charlotte Botha PhD**
  Emerson Research Project Advisor
  Assistant Professor of Music
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