Tiankuo Chu

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Overview

Machine Learning Engineer | **PhD in Medical AI** | GenAI / LLM Infra / RAG / LoRA / MLOps | **ICLR first author (ICLR 2025)** | Led end-to-end deployment of **production-grade LLMs** system **(Github Demo)** | Passionate about scalable and trustworthy **GenAI** in **healthcare** and industrial domains.

Education

University of Delaware, Newark, DE, USA — *Sep 2019 - Dec 2025 (expected)*
Ph.D. candidate, Mechanical Engineering — *GPA:3.96/4.0*
Relevant graduate-level Computer Science courses: Machine Learning, Deep Learning, Data Structures and Algorithms

Beijing University of Chemical Technology, Beijing, China — *Sep 2014 - May 2018*
Bachelor of Engineering, Polymer Materials & Engineering — *GPA:3.73/4.0 (Top 1%)*

Work Experience

Dow, Houston, Texas — *May 2025 — Present*
Machine Learning Engineer Intern

- **GraphRAG + LoRA + vLLM System for Root-Cause Analysis & LLMOps Deployment**
  - Designed and deployed a **modular LLM pipeline** combining **LangChain, Graph-based RAG, FAISS, and LoRA-fine-tuned LLaMA 3–70B**; deployed on **SLURM-managed 7 × H100 HPC cluster with vLLM**, supporting 1,000+ queries/hour with 45% latency reduction and 18% improvement in output faithfulness.
  - Built and validated **"JudgeLLM"**, a modular LLM evaluator that scores LLM outputs on relevance, faithfulness, and accuracy; designed for integration with autonomous task chains and tool-using agents enabling self-reflective validation.
  - Engineered complete **LLMOps infrastructure**: containerized microservices using **FastAPI, Docker, and Kubernetes**; implemented GitHub Actions pipelines for CI/CD, model versioning, continual fine-tuning, and embedding refresh.
  - Collaborated effectively with **HPC, TS&D, and UI teams** to integrate with Dow's customer service platforms; enabling automated analysis of **18,000+** unresolved global complaints and yielding **$18 M/year** in operational savings.
  - Open-sourced a standalone, end-to-end **demo version** of QA system **MediGraph-QA** (GitHub), adapted for single-GPU (A6000) deployment; demonstrates LoRA fine-tuning, GraphRAG retrieval, vLLM serving, and full MLOps automation.

Globus Medical, Audubon, Pennsylvania — *Jun 2023 — Sep 2023*
Software Engineer Intern

- **Developed Scalable Data Pipelines for Multimodal Human Spine Medical Dataset Machine Learning Application**
  - Engineered robust **data pipelines** handling over **10TB** of real-world **multimodal medical data** collected from **6+ hospitals** across the U.S., including **X-ray, CT, MRI**, and **electronic medical records (EMRs)**. Implemented **data validation, cleaning, standardization, and curation** workflows to produce high-quality, structured datasets for downstream **machine learning tasks** across multiple R&D teams.
  - Built a **Gradio-based annotation platform** integrated with a pretrained **YOLOv5** model, reducing manual **data labeling time by > 90%** and saving approximately **$30,000** in labeling costs.
- **End-to-End ML Solution for Automated Spine Implant Detection and Classification**
  - Designed and deployed an **end-to-end machine learning pipeline** using curated **10TB** multimodal dataset and **YOLOv5**(PyTorch), targeting **automated spinal implants detection and classification** from **X-ray images**, achieving a **28% improvement** in real-time **detection accuracy** over baseline methods and directly supporting **pre-op and post-op surgical evaluations** in robot-assisted spine surgeries. This model was successfully **integrated into the FDA-cleared** ExcelsiusHub® platform, launched by **Globus Medical** in 2024.

Research Experience

University of Delaware, Newark, DE *Sep 2019 — Present*
Research Assistant

- **Led the Development of BoneMet: A Large-Scale AI-Ready Open-Source Multimodal Breast Cancer Bone Metastasis (BCBM) Medical Dataset**
  - Directed a **cross-functional team** to create **BoneMet**, the first **AI-ready**, open-source **multimodal** murine **medical dataset** targeting **Breast Cancer Bone Metastasis (BCBM)**. The dataset includes over **67TB** of meticulously curated, **spatial-temporally aligned** multimodal data: **2D X-rays, 3D CT scans**, and **biological metadata**. Released via Hugging Face with **5,000+ downloads in the first month**.Project secured a competitive **$300K** NIH research grant to support **foundation model training** and **downstream clinical applications**.
- **Designed Custom Vision Transformer & Medical Foundation Model for MLLMs and GenAI Diagnosis**
  - Engineered a novel **Spatial-Temporal Aligned Vision Transformer (STA-ViT)** with **angle-aware** and **time-aware** feature extraction, enabling robust **multidimensional representation learning** on BoneMet data. Integrated **Masked Autoencoder (MAE)** and **Swin Transformer** for **self-supervised pretraining** and **supervised fine-tuning**, improving **early diagnosis accuracy by 10.1%** and boosting model **generalizability**.
  - Developed and fine-tuned a **Multimodal Vision-Language Model (LLaVA)** combining **STA-ViT as image encoder** and **LLaMA-2 as text decoder**, trained on **ROCO** and **BoneMet** for **medical image-text generation**, demonstrating capability in **early diagnostic report generation** using **prompt-based multimodal inference**. This was accepted as a **first-author paper** paper at the top-tier **International Conference on Learning Representations (ICLR 2025)**.

Representative Conference Papers and Journal Papers

T. Chu, F. Lin, S. Wang, J. Jiang, W. Gong, X. Yuan, L. Wang, “BoneMet: An Open Large-Scale Multi-Modal Dataset for Breast Cancer Bone Metastasis Diagnosis and Prognosis”, **International Conference on Learning Representations (ICLR)**, 2025.

T. Chu, M. Collado, S. Izquierdo, E. Cooper, K. Shajpaul, C. James, S. McGriff, D. Wheeler, K. Ofori, H. Chow, Y. Kim, L. Wang, "Combined Senolytics and 11-Week Treadmill Running Reversed the Declining of Bone Tissue Mineral Density in Aged Mice with Parkinson Disease", Orthopaedic Research Society (ORS), 2025, **Oral**.

S. Wang, **T. Chu**, X. Yuan, L. Wang, "Prognostic Assessment of Bone Mechanical Properties with Metastatic Osteolysis Using Neural Network and Finite Element Analysis", **Mechanobiology in Medicine**, 2025.

T. Chu, M. Wasi, R. Guerra, X. Song, J. Mourtada, L. You, L. Wang, "Skeletal response to Yoda1 and whole-body vibration in mice varied with animal age, bone compartment, treatment duration, and radiation exposure", **Bone**, 2025, Bone.

M. Wasi, **T. Chu**, R. Guerra, R Kooker, K Maldonado, X Li, CY Lin, X Song, J. Xiong, L. You, L. Wang, “Mitigating aging and doxorubicin induced bone loss in mature mice via mechanobiology based treatments”, Bone, 2024.

Latest Academic honors & awards

- Doctoral Fellowship for Excellence Award (Dean nominated, top 2) 2025
- Diana Jacobs Kalman/AFAR Scholarships for Research in the Biology of Aging 2025

Certifications & Courses

• DeepLearning.AI: LangChain for LLM Application Development (2024)
• AWS Machine Learning Fundamentals (2023)
• Hugging Face Transformers Course (2023)

Skills

Programming:	Python, SQL, C++
LLM & Deep Learning:	PyTorch, Transformers, LLaMA, RAG, Prompt Engineering, LoRA, vLLM
MLOps & Infrastructure:	Docker, Kubernetes, CI/CD (GitHub Actions), FastAPI, Flask, SLURM, AWS (EKS/SageMaker), Azure
Data & Libraries:	Pandas, NumPy, Scikit-learn, OpenCV, FAISS
Systems :	Unix/Linux