Zhiling Chen

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Education

- **University of Connecticut** *Aug. 2023 - present*
  Ph.D. student at Mechanical Engineering, advised by Prof. Farhad Imani Storrs, CT
- **Boston University** *Sep. 2021 - Aug. 2022*
  Master of Science in Applied Data Analytics Boston, MA
- **Waterford Institute of Technology** *Sep. 2020 - June. 2021*
  Bachelor of Science (Honours) in Software Engineering Practice Waterford, Ireland
- **Nanjing University of Information Science & Technology** *Sep. 2017 - June. 2021*
  Bachelor of Engineering in Software Engineering Nanjing, China

Skills

- **Programming & Frameworks:** Python, Java, Javascript, R, HTML, Git, Linux, ROS2, PyTorch, TensorFlow
- **Machine Learning & AI:** Vision Language Models(CLIP, BLIP, Siglip), Multimodal Large Language Models(QwenVL series, LLava series, InternVL series, GPT series, Gemini), Retrieval-Augmented Generation, Object Detection Models(YOLO series, Grounding DINO series)
- **Robotics:** UR3 robot control, MoveIt, Isaac Sim
- **Design&3D Modeling:** 3D printing, SolidWorks, Blender, OpenSCAD
- **Databases & Tools:** MySQL, Oracle, Docker

Research Interests

My research focuses on the intersection of machine learning and smart manufacturing, with particular emphasis on Vision-Language Models and robotics, especially in the areas of cooperative robotics and embodied robotic systems.

Selected Projects

- **ScanBot: Instruction-Conditioned Robotic Surface Scanning Dataset** *Fed 2025 - May 2025*
  Tools: UR3 Robot Arm, Keyence LJ-X8200, RealSense D435i, GoPro, ROS2, PyTorch [GitHub]
  - Developed **ScanBot**, the first multimodal dataset for instruction-conditioned robotic surface scanning, covering 12 objects across 6 industrially relevant task types.
  - Implemented a **robotic scanning system** integrating UR3 arm, Keyence LJ-X8200, RealSense D435i, and GoPro to capture synchronized RGB-D, laser profiles, robot states, and third-person video.
  - Created a **comprehensive benchmark** by evaluating state-of-the-art MLLMs (GPT-4.1, OpenAI o3, Gemini 2.5) on perception–planning–execution loops, revealing key limitations in trajectory stability and parameter tuning.
- **MoXpert: Multi-Expert Framework for Industrial Anomaly Detection with MLLMs** *Sep 2024 - Dec 2024*
  Tools: CLIP, Faiss/HNSW, PyTorch, GPT-4o, Gemini2, Qwen2-VL, LLaVA, InternVL2 [GitHub]
  - Proposed **MoXpert**, a gated Mixture-of-Experts framework with four expert modules (Reference Extractor, Knowledge Guide, Reasoning Expert, Decision Maker) to enhance MLLM-based industrial anomaly detection.
  - Implemented a **multimodal RAG system** using CLIP embeddings and HNSW indexing to efficiently retrieve the most similar normal images and domain-specific knowledge for defect evaluation.
  - Achieved **state-of-the-art results** on MVTec-AD and VisA benchmarks: +7.39% in anomaly discrimination and +4.40% in defect classification compared to the baseline Qwen2-VL.
- **Clip2Safety: VLM-based Framework for Workplace Safety Compliance Detection** *march 2024 - June 2024*
  Tools: CLIP, BLIP2, YOLO-World, OWLv2, Grounding DINO, GPT-4o, PyTorch, FlashAttention [GitHub]
  - Proposed **Clip2Safety**, a multi-module framework (scene recognition, visual prompt, safety gear detection, fine-grained verification) to address PPE non-compliance in dynamic workplaces.
  - Implemented a **two-stage detection pipeline**: YOLO-World for open-vocabulary object detection and CLIP-based embedding alignment for verifying fine-grained PPE attributes (color, material, functionality).
  - Achieved **72.3% accuracy** in safety gear detection and attribute verification with **21× faster inference** than baseline VQA models (e.g., LLaVA-1.6-7B), enabling real-time deployment.

Publications Google Scholar

[1] Zhiling Chen*, Danny Hoang, Ruimin Chen, Farhad Imani. **Distributed Hyperdimensional Computing for Real-Time Data Aggregation and Interpretable Quality Monitoring in Manufacturing**. *IMECE 2024*.

[2] Zhiling Chen*, Danny Hoang, Fardin Jalil Piran, Ruimin Chen, Farhad Imani. **Federated Hyperdimensional Computing for Hierarchical and Distributed Quality Monitoring in Smart Manufacturing**. *Internet of Things*.

[3] Zhiling Chen*, Hanning Chen, Moshen Imani, Ruimin Chen, Farhad Imani. **Vision Language Model for Interpretable and Fine-grained Detection of Safety Compliance in Diverse Workplaces**. *Expert Systems with Applications*.

[4] Fardin Jalil Piran*, Zhiling Chen, Moshen Imani, Farhad Imani. **Privacy-preserving Federated Learning with Differentially Private Hyperdimensional Computing**. *Computers and Electrical Engineering*.

[5] Zhiling Chen*, Hanning Chen, Moshen Imani, Farhad Imani. **Can Multimodal Language Model be Guided to Improve Industrial Anomaly Detection?** *Arxiv [Under Review]*.

[6] Kiarash Naghavi Khanghah*, Zhiling Chen, Lela Romeo, Qian Yang, Rajiv Malhotra, Farhad Imani, Hongyi Xu. **Multimodal RAG-driven Anomaly Detection and Classification in Laser Powder Bed Fusion using Large Language Models**. *2025 DFMLC Best Paper Award*.

[7] Zhiling Chen*, Yang Zhang, Fardin Jalil Piran, Qianyu Zhou, Jiong Tang, Farhad Imani. **ScanBot: Towards Intelligent Surface Scanning in Embodied Robotic Systems**. *Arxiv [Submitted to ICRA]*.

[8] Zhiling Chen*, Farhad Imani. **A Multi-Expert Framework for Enhancing Multimodal Large Language Models in Industrial Anomaly Detection**. *[Under Review]*.

[9] Kiarash Naghavi Khanghah*, Zhiling Chen, Lela Romeo, Qian Yang, Rajiv Malhotra, Farhad Imani, Hongyi Xu. **Zero-Shot Anomaly Detection in Laser Powder Bed Fusion Using Multimodal RAG and Large Language Models**. *[Under Review]*.

Experience

• **UCONN ISCL Lab [🌐]** *Aug. 2023 - Present*
Research Assistant Storrs, CT

- Application of Vision-Language Models for Industrial Anomaly Detection
- Collected and implemented VLA datasets using UR3 robot and laser profiler for robotic learning tasks.

Additional Information

Languages: English (Proficiency level), Mandarin (Native Speaker)
Interests: Snowboarding, boxing, climbing