# Ziming Luo

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## OBJECTIVE

Aspiring to contribute to cutting-edge advancements in LLM-based systems, with a focus on enabling explainable and faithful reasoning across modalities. Seeking a research-driven position where I can leverage my expertise in large language models and computer vision to drive innovation in autonomous scientific experimentation, interdisciplinary AI techniques, and alignment of AI with human values.

## EDUCATION

• **University of Michigan** — Ann Arbor, MI
*MSc in Electrical and Computer Engineering* — *Aug 2023 - Present*
◦ GPA: 4.00/4.00

◦ Completed Coursework: Foundation of Computer Vision (A+), Advanced Topics in Computer Vision (A), Large Language Model (A), Machine Learning (A), Probability and Random Process (A+), Matrix Methods for Signal Processing, Data Analysis and Machine Learning

• **Shenzhen University** — Shenzhen, China
*BSc in Information and Computing Science (Honours degree)* — *Sept 2019 - July 2023*
*BSc in Computer Science and Technology* — *Sept 2019 - July 2023*
◦ GPA: 3.88/4.00

◦ Selected Coursework: Data Structure (A+, 93/100), Computer Systems (A, 90/100), Software Engineering (A+, 93/100), Mathematical modeling (A+, 93/100), Numerical Analysis(A+, 94/100), Mathematical methods for image processing (A+, 94/100), Overview of Artificial Intelligence (A+, 93/100), Preliminary Machine Learning (A+, 93/100), Practice and Application of Deep Learning (A+, 97/100), Computer Vision (A, 91/100)

## EXPERIENCE

• **University of Michigan [🌐]** — Ann Arbor, MI
*Graduate Researcher* — *May 2024 - Present*
◦ Proposed an end-to-end point cloud-based open vocabulary 3D scene graph pipeline for robot navigation without the need for well-aligned posed images.

◦ Presented a point cloud-based room segmentation and classification pipeline which possesses the SOTA ability to comprehend highly complex and real-world scenes.

◦ Presented a point cloud-based open vocabulary 3D object detection and classification pipeline that can reached the better performance compared with previous SOTA algorithm.

• **University of Texas at Dallas [🌐]** — Remote
*Graduate Researcher* — *May 2024 - Present*
◦ Introduced a comprehensive taxonomy categorizing hallucinations in complex multi-step reasoning tasks into six distinct types.

◦ Proposed an automatic data augmentation method to synthesize the six types of fine-grained hallucination data, and developed a compact process reward model (PRM) to these hallucination types.

◦ Conducted step-by-step verification and reinforcement learning fine-tuning for language models to validate our PRM. Experimental results demonstrated that our PRM can significantly boost performance of language models in mathematical reasoning tasks.

## PATENTS AND PUBLICATIONS          C=CONFERENCE, J=JOURNAL, P=PATENT, S=IN SUBMISSION

* Denotes co-first authors

[S.1]  **Luo Z.***, Li R.*, Du X. **Fine-Grained Reward Models for Hallucination Detection in LLM Reasoning**. Manuscript submitted to *COLING 2025*.

[S.2]  Xu Y., **Luo Z.**, Wang Q., et al. **Point2Graph: An End-to-end Point cloud-based Open-Vocabulary 3D Scene Graph for Robot Navigation**. Manuscript submitted to *ICRA 2025*.

[P.1]  **An Entity Alignment Method for Knowledge Graph of Customs Import and Export Goods**. CN Patent, Patent No. CN115641599A. Grant Date: Nov 03, 2022, Publication Date: Jan 24, 2023.

[P.2]  **A Quality Assessment Method of Declared Customs Import and Export Goods**. CN Patent, Patent No. CN115640400A. Grant Date: Nov 03, 2022, Publication Date: Jan 24, 2023.

[P.3]  **A Risk Identification Method for Customs Import and Export Commodities Based on Declaration Quality Assessment**. CN Patent CN115617979A, filed Nov 11, 2022, and issued Jan 17, 2023.

[J.1]  **Luo Z.**, Gao C., Zhou J. **Rough sets-based tri-trade for partially labeled data.** *Applied Intelligence* (IF: 5.3), 2023.

[C.1]  Ming S., H. Liu., **Luo Z.**, et al. **Label-Aware Recurrent Reading for Multi-Label Classification**. *2022 Asia Conference on Algorithms, Computing and Machine Learning (CACML)*. IEEE, 2022.

## PROJECTS

- **DPO-Assisted Model Alignment Through Knowledge Distillation** *Jan 2024 - May 2024*

  Report & Code [⭘]

  ◦ Proposed Direct Preference Optimization Knowledge Distillation (DPO-KD), a novel method for aligning small language models with human preferences without relying on costly human annotation.

  ◦ Leveraged advanced models like GPT-4 and Gemini as teacher models in DPO-KD, refining smaller student models through knowledge distillation. This method involves generating datasets of preferred and rejected outputs, applying Direct Preference Optimization for model fine-tuning. DPO-KD includes both online and offline versions, with the online version dynamically updating training datasets based on the student models progress.

  ◦ Conducted experiments on code summarization and code generation tasks, demonstrating that DPO-KD significantly enhances student model performance in code summarization, though it resulted in a performance decline in code generation tasks.

- **Exploring Self-Learning and Teacher-Guided Paradigms in Language Model Alignment** *Jan 2024 - May 2024*

  Report & Code [⭘]

  ◦ Utilized Phi-2 as the student model and Gemini as the teacher model to compare three alignment strategies: self-reward, teacher-reward, and teacher-demonstration, focusing on instruction-following and reward modeling.

  ◦ Conducted head-to-head evaluations and AlpacaEval 2.0 assessments, demonstrating that the teacher-demonstration and teacher-reward models outperformed the SFT and self-reward models in instruction-following, with the teacher-demonstration model achieving the highest improvements.

  ◦ Assessed reward accuracy and relevance using statistical metrics, revealing that the self-reward and teacher-demonstration models did not improve or declined after fine-tuning, while the teacher-reward model significantly improved its reward modeling ability.

- **Fast Food Chain Store Management - Dropped Food Recognition** *Oct 2023 - Dec 2023*

  Report & Code [⭘]

  ◦ Developed a computer vision solution to enhance hygiene and customer experience in fast food chains by detecting burger buns that drop on the ground unnoticed. Implemented a unified real-time video surveillance pipeline capable of edge computing deployment on terminal devices.

  ◦ Food detection: Trained a YOLOv8 food instance detector; Ground segmentation: Applied the SLIC algorithm to segment ground superpixels; Drop detection: Utilized a pre-trained ResNet50 as a feature extractor and trained a multilayer perceptron to identify burger drops on the ground.

- **Customs Commodity Tax Evasion Identification** *Jun 2021 - Sep 2022*

  ◦ Designed and constructed a commodity knowledge graph using customs entry form data, integrating data cleaning, data mining, and distributed storage, and implemented in the Neo4j graph database.

  ◦ Developed mathematical models based on the knowledge graph to detect corporate tax evasion, identifying key indicators such as false commodity reporting and under-reporting of prices, which led to the recovery of over **RMB 20 million** in evaded taxes for Shenzhen Customs by 2022.

  ◦ Secured funding as the project leader from the *National College Student Innovation and Entrepreneurship Training Program* and the *Guangdong Provincial Science and Technology Innovation Strategy Special Fund*.

  ◦ Registered software copyright for the "Customs Knowledge Graph System" (as the primary contributor), enabling functions for commodity information query, statistics, and visualization.

## SKILLS

- **Programming Languages:** C, C++, Java, Python, MATLAB, Julia, MySQL
- **Web Technologies:** HTML, JavaScript, CSS, Vue, Flask, Node.js
- **Data Science & Machine Learning:** Sklearn, Pandas, Matplotlib, Scipy, Tableau
- **Deep Learning:** PyTorch, TensorFlow, Hugging face, OpenCV, Prompt Engineering
- **Other Tools & Technologies:** Linux, Git, VSCode, Latex

## HONORS AND AWARDS

- **The Wang Kuo Tong Memorial Fellowship [🌐]** - One award each year *2023-2024*
- **Outstanding Graduate Award of Shenzhen University** - Top 3% Graduates *June 2023*
- **Scholarships of Shenzhen University** *2020-2023*

## ADDITIONAL INFORMATION

- **First-generation college student**
- **Languages:** Chinese (Native level), English (Proficiency level)
- **Interests:** Basketball, hiking, cooking