Jinhui Liu

✧ Currently working on LLM-based RAG and Agent system
✧ Research Experience: 6D object pose estimation, object detection, and face recognition
✧ Research Interest: multi-modal learning
✧ Honor: Outstanding Student Scholarship for 3 years

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💼 Work

2022/07 - present	Algorithm Researcher	**SenseTime Corporation**

I developed the **LLM-based RAG system** which has been applied to our business clients and received **85%** Effectiveness. Our RAG system focuses on Financial fields and supports tens of thousands of documents. I design several advanced modules to promote performance, such as the **intention recognition module**, **fuse retriever**, and **automated retriever router**.

Currently working on evolving our RAG system to an advanced **Agent** system that can handle more complex tasks with tools, including **question decomposition** and **data visualization**.

🗄 Research

6D Pose Estimation From a Single RGB Image　　　　　　Baidu Intern, 2020/05 - 2020/08

I contributed to building the overall pose estimation framework and was responsible for the 2D detection module. We participated in the BOP Challenge 2020. Our approach improved performance by around **10%** compared to the top performer in 2019, and we finished **in 3rd place**. Our work was published in **ECCV 2020**.

Glaucoma Detection Across Diverse Fundus Images　　　　　　　　　　2020/10 - 2021/05

I leverage the unsupervised **domain adaptation** technique to effectively reduce the obvious appearance discrepancy of fundus images. Specifically, I design a **style transfer** model which improves glaucoma detection accuracy by **5%**. The work was published in **CICAI 2021**.

Exploring the Issue of Racial Bias in Face Recognition Models　　　　　2021/07 - 2023/05

We design an ethics-aware method using synthesized faces to achieve a racially balanced, high-accuracy face recognition model. Specifically, We introduce a race-controllable and identity innumerable face synthesis approach to generate synthetic face images and mitigate recognition imbalance among different races despite the scarcity of consenting face images. The work was published in **Neurocomputing2024**.

🎓 Education

Master's degree	Sep. 2019 ~ June 2022, School of Software, Tsinghua University
Bachelor's degree	Sep. 2015 ~ June 2019, School of Computer Science, Wuhan University

✒ Publications

Xiaobiao Du, Xin Yu, Jinhui Liu, Beifen Dai, Feng Xu, Ethics-aware face recognition aided by synthetic face images, Neurocomputing 2024.

Jinhui Liu, Zhikang Zou, Xiaoqing Ye, Xiao Tan, Errui Ding,Feng Xu, and Xin Yu. Leaping from 2d detection to efficient 6dof object pose estimation. In ECCV, pages 707-714.Springer, 2020.

Liu, Jinhui and Yu, Xin. Few-shot Weighted Style Matching for Glaucoma Detection. First CAAI Intern- ational Conference, CICAI 2021, Hangzhou,　　China, 5-6 June 2021. Cham, Switzerland: Springer.

Personal   Statement

My name is Jinhui Liu, and I am writing to express my interest in pursuing a PhD in Computer Science at Columbia University. I received my Bachelor's degree from the School of Computer Science at Wuhan University and Master's degree from the School of Software at Tsinghua University where I gained valuable research experience in computer vision (CV), 6D pose estimation, and face recognition. Currently, I am working in the industry as an algorithm researcher, focusing on the application of large language models (LLMs), including Retrieval Augmented Generation (RAG) and Agent systems. My primary research interest lies in multi-modal perception and analysis, and I believe my research experience in both CV and NLP offers me a good foundation for this research area.

1. Undergraduate -- build a foundation and never settles

My four years of study at Wuhan University laid a solid foundation in computer science and programming. Before college, I had no exposure to programming. To make things worse, programming has so much to offer: countless languages and frameworks to learn. One valuable principle I learned from my teacher that I still follow today is: "Study when you need it because that gives you the chance to practice." I never slacked off and my efforts paid off. I achieved full GPA scores in several specialized courses and received the Outstanding Student Scholarship for three years.

In my fourth year of undergraduate, I was offered a recommendation for graduate study at Wuhan University. However, I didn't want to stay in my comfort

zone. I wanted to challenge myself and create more opportunities for my future. Eventually, I succeeded in the entrance exam and was admitted to the School of Software at Tsinghua University, where I began my graduate study.

2. Graduate -- three projects make me a competent researcher

My first research project was *6D pose estimation for rigid objects*. The core challenge was to estimate the 6D pose of an object from a single RGB image. My supervisor, Professor Feng Xu, and my mentor, Professor Xin Yu, provided significant support during this project. Since I lacked research experience during my undergraduate years, I felt a lot of pressure at first and had little understanding of how to conduct research. However with the patient guidance of my professors, I gradually mastered the skills needed for research. I learned how to analyze the shortcomings of current algorithms, how to verify if an idea is effective, and how to find solutions to difficult problems by reviewing relevant literature and learning from others' work. Thanks to the dedicated guidance of my professors and the hard work of my partners, we completed the project and published a paper, which became my first research publication.

With the research experience from my first project, I began attempting to independently complete a research topic under the guidance of my supervisor.

The project was about glaucoma detection from fundus images. The core issue I needed to address was the big variations between fundus images collected from different devices. Under my supervisor's guidance, I explored the domain adaptation method and it inspired me to use such method to resolve the differences in fundus images. I developed an adaptation model, which improved accuracy by 5%, and we

published a paper. In this project, I independently carried out the entire research process, from topic selection, data collection, literature review, coding, to writing the paper. The publication of the paper greatly boosted my confidence.

My last research project focused on the issue of racial bias in facial recognition models. The most valuable lesson I learned from this project was how to identify problems and select research topics, which my supervisor taught me. The accuracy of current facial recognition models is already quite high, and improving it further is costly and difficult. However, by considering the problem from a different perspective, I realized that besides accuracy, the difference in performance across races is also a critical issue that cannot be overlooked. Thanks to my supervisor's thoughtful guidance, we successfully published this work as well. These three research projects helped me grow from a novice researcher into a competent one.

After graduation, I decided to gain industrial experience first because I believed that practical experience in the industry would greatly benefit my research by giving me a better understanding of the problems faced in real-world applications.

3. Industry -- LLM inspires me to research

The advent of ChatGPT and subsequent LLMs has brought AI research into a new phase. I was fortunate to be assigned to the LLM department. Although I had no prior experience in NLP research, I deeply value this opportunity. I worked hard to study NLP background knowledge and kept up with the latest advancements in LLMs in the meantime. Eventually, I led the development of an LLM-based RAG system and Agent system, which helped the company win several business deals. The emergence of LLMs also made me curious about the next step of AI evolution.

4. Looking to the future -- Pursuing PhD at Columbia University

After reviewing the current progress in academia and industry, I believe that multi-modal learning will be the next breakthrough. I am excited because my research experiences in both CV and NLP have provided me with a strong foundation for this area, which is why I have decided to pursue a PhD and research in this topic.

As one of the Ivy League schools, Columbia University has a long-standing tradition of excellence in computer science and artificial intelligence, with a wealth of experienced and renowned professors in areas such as NLP, CV, multi-modal, and robotics. Talented students from all over the world come to Columbia to pursue their studies, and I believe that collaborating with such brilliant minds will make research much more effective. That's why I've decided to apply for Columbia's PhD program. I am looking forward to doing remarkable research under the guidance of distinguished professors.