My passion for computer graphics has directed my academic path. I am particularly excited about your research on Neural Representations and Rendering for 3D Reconstruction, which aligns closely with my current interests and experiences. I am writing to inquire about potential opportunities to contribute to your lab’s work as a 2025 summer research intern.

Currently, I am fortunate to be mentored by Professor Wang Beibei from Nanjing University through the GAMES Graphics Rising Stars program. My focus lies in 3D reconstruction-related research. I began by replicating the SIGGRAPH 2023 Best Paper, *3D Gaussian Splatting for Real-time Radiance Field Rendering*. This not only deepened my understanding of Neural Radiance Fields but also inspired me to extend my learning by studying Structure-from-Motion, Multi-View Stereo and Neural Rendering principles through MIT 6.S980 course. Then, I was inspired by the paper *LM-Gaussian: Boost Sparse-view 3D Gaussian Splatting with Large Model Priors*. So, at present, I am curious about methods to enhance the quality of 3D Gaussian splatting in sparse-view settings, a challenge that overlaps with your research interests.

Previously, I conducted the Optimization on Instant-NGP: A Video-to-Mesh Pipeline project when I was attending the MIT Winter Research Program. My team and I improved the Instant-NGP pipeline to transform videos into high-quality meshes. We first studied the paper of *NeRF* and *Instant Neural Graphics Primitives with a Multiresolution Hash Encoding* (Instant-NGP). We improve the image filtering and mesh smoothing processes to boost the speed and accuracy of 3D model development, expediting the entire 3D modeling process. Additionally, I successfully replicated the Instant-NGP pipeline, using its multi-scale hash grid to enhance rendering speed while also managing custom datasets for training and validating video inputs and mesh outputs, which improved the overall project efficiency.

In the process, we tried to use python opensource library for image filtering and automation, and the application of the Laplacian smoothing algorithm, as well as made a comparison of standard NeRF and Instant-NGP. This training enriched my knowledge of 3D reconstruction and helped me see its vast potential in practical use. I am more than delighted to see the combination of traditional graphics pipeline with SOTA deep learning methods. The success of this project was highlighted at the MIT xPro conference, which displayed a great balance of smoothness and feature retention. The research poster can be found [here.](https://drive.google.com/file/d/1_wi9doFBbsM7rdyhOkGLsRGGuL-IvRuS/view?usp=sharing)

During the Instant-NGP project, I realized that my foundation in computer graphics needed improvement, so I went back to self-study rendering theories and techniques. This later led to my focus on physically based rendering. I found synthesizing a realistic image of the world particularly interesting. Using the glfw library for OpenGL context creation, I built a Physically-Based Renderer from scratch to render models from 3D model websites such as Sketchfab. The key part was to implement the metallic-roughness workflow, following real world physics law, and develop an Image-based lighting system in order to enhance light effect realism. Through this, I had a better understanding of Physically Based Rendering (PBR) principles and their actual application, as well as further honed my C++ skills.

During my academic journey, I realized the powerful synergy between deep learning, computer vision, and graphics in addressing complex problems. Therefore, I actively pursued projects in both fields. I led a research project that utilized Gradient Boosting Decision Trees to predict second-hand car prices. And I explored enhancing large language models with mathematical reasoning by applying Supervised Fine-Tuning (SFT) and Reinforcement Learning with Human Feedback (RLHF). In addition to these AI projects, I took part in a Tumor Detection project where I employed image segmentation techniques to identify tumors in medical images.

These experiences have allowed me to explore the possibilities at the intersection of computer vision, graphics and AI. In the future, I look forward to bringing my knowledge and skills to your ongoing research. I would be deeply grateful for the opportunity to collaborate with you and your team while continuing to grow as a researcher under your mentorship.

Thank you for considering my application. I look forward to the possibility of discussing how my background and interests align with your research in meeting.

Best regards,

Jinrui Zhang