BENRAN HU

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA
Master of Science in Computer Science | CGA: 4.19/4.3 — *Dec 2024 (Expected)*

Hong Kong University of Science and Technology — Hong Kong SAR
Bachelor of Science in Data Science and Technology, and in Computer Science | CGA: 4.14/4.3 — *Jun 2023*

- Major CGA: 4.19/4.3. First Class Honors. Recipient of the Academic Achievement Medal.

SKILLS

Programming Languages: `C/C++, Python, C#, Java, JavaScript, HTML`
Frameworks and Tools: `PyTorch, TensorFlow, CUDA, OpenMP, OpenMPI, Vulkan, WebGL, Unity, Blender`

RESEARCH EXPERIENCE

Uncertainty Quantification in Differentiable Rendering — *Sep 2023 - Present*

- Proposed an efficient and general method to quantify the aleatoric and epistemic uncertainty with respect to the parameters in various inverse rendering tasks via uncertainty propagation.

Segment Anything for NeRF [CVPR'24] | — *Apr 2023 - Nov 2023*

- Proposed a method to perform high-quality promptable interactive segmentation in Neural Radiance Field.

NeRF Instance Segmentation [ICCV'23] | — *Dec 2022 - Jul 2023*

- Proposed one the first 3D instance segmentation methods in NeRFs by optimizing a Neural Instance Field.

Temporally Adaptive Shading Scheduling — *Sep 2022 - Present*

- Maximized rendering quality under frametime or bandwidth constraints by adjusting local temporal shading rates with scheduling, error prediction, and reprojection.

Object Detection in NeRF [CVPR'23] | — *May 2022 - Nov 2022*

- Proposed the first significant 3D object detection method in Neural Radiance Fields.
- Created the first large synthetic indoor dataset for NeRF 3D object detection with Blender and public assets.

PUBLICATIONS

Yichen Liu, **Benran Hu**, Chi-Keung Tang, and Yu-Wing Tai. SANeRF-HQ: Segment Anything for NeRF in High Quality. *arXiv preprint arXiv:2312.01531*, 2023. |

Yichen Liu*, **Benran Hu***, Junkai Huang*, Yu-Wing Tai, and Chi-Keung Tang. Instance Neural Radiance Field. In *Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV)*, October 2023. |

Benran Hu*, Junkai Huang*, Yichen Liu*, Yu-Wing Tai, and Chi-Keung Tang. NeRF-RPN: A general framework for object detection in NeRFs. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, June 2023. |

TECHNICAL PROJECTS

Vulkan Mesh Shading and Culling — *Vulkan, Mesh Shading, Culling*

- Built a highly efficient meshlet shading and culling pipeline in Vulkan utilizing mesh shaders and task shaders.

Metarenderer — *WebGL, PBR, JavaScript*

- Developed a rendering playground based on three.js and WebGL, featuring interactive experiments of cameras, shading models, lighting, culling, texture mapping, shadow mapping, microfacet materials, and PRT.

Wavefront Path Tracing — *CUDA, GPU Programming, Path Tracing*

- Implemented a CUDA path tracer with wavefront design and wide BVH which achieves a maximum speedup of 1.79x compared to megakernel implementation, and 8.20x compared to multi-thread CPU implementation.

Geometry Processing Pipeline — *Geometry Processing, Reconstruction, Animation*

- Built the full pipeline from shape acquisition to rigged models, including surface reconstruction, mesh smoothing, mesh parametrization, mesh deformation, skinning, and skeletal animation.