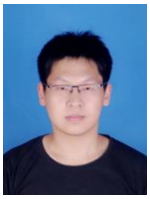
Zheng Han



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EDUCATION

Master, Communication and Information Engineering, Xidian University 08/2020 - Present

- GPA: 93.66/100 | Class Rank: **1st/584**
- 2021 "Excellent Graduate Student" of Xidian University.

Bachelor, **The Class of Excellent Engineer**, Telecommunications, Xidian University 08/2016 - 07/2020

- GPA: 3.7/4.0

RESEARCH EXPERIENCE

✧ **Real-Time Mixed Reality Guidance in Hepatectomy** 09/2020 - Present

Project Description: Conventional hepatectomy faces many challenges. Specifically, the structure of liver blood vessels is complex, and intraoperative emergencies are common. More seriously, excess resections often have a negative impact on the postoperative liver function in patients, causing postoperative complications that impede patients' recovery. All of these factors prevent surgeons from performing a safe hepatectomy. To tackle these problems, I developed the **first** interactive mixed reality operation-supportive system. This system provides real-time visualization of surgical anatomy to guide the implementation of resection plans, ultimately helping surgeons perform simple, clean, and fast surgery.

Results:

- Two superiority trials have been carried out on animals. Experiments have demonstrated that the developed mixed reality system outperforms intraoperative ultrasonography in the blood vessel identification and surgery accuracy.
- The project has passed the **ethical review** and entered the **clinical trial** stage.
- The system has been **integrated into the standard operating procedure for hepatectomy** by the Department of Hepatobiliary Surgery of the First Affiliated Hospital of Xi'an Jiaotong University. Six patients have undergone mixed reality assisted hepatectomy so far, some of whom can be found on my **personal website**.
- The postoperative questionnaire results showed that most surgeons agreed that real-time mixed reality played a positive role in relieving their preoperative anxiety and in the planning and implementation of the surgery.
- **Our findings are being compiled as a journal article which will be submitted to the Journal of the American Medical Association (JAMA, IF: 56.3)**.
- The system will be made **publicly available**. We hope to see more interest and work in this research worldwide and make our contributions to the development of precision surgery.

✧ **Keypoint-Driven Neural Head Avatars** 09/2021 - Present

Project Description: Compared with 2D displays, 3D displays can provide a more immersive visual experience for users. However, as the information carrier for 3D displays, 3D models face the challenge of excessively large data volumes. This issue further leads to excessive network transmission overhead. The current point cloud codec schemes have high hardware requirements, which are hardly implemented on commercial HMDs, ultimately hindering the commercialization of XR. Focusing on video conference scenarios, I am investigating **a 3D facial video compression and transmission scheme** based on **self-supervised learning**, aimed at tackling the aforementioned issues. Firstly, the motion vectors of the human face are extracted by analyzing the three-dimensional facial structural features. Subsequently, the motion

vectors are compressed with the help of a graph convolutional neural network, and then transmitted. Finally, using neural rendering, the texture details of the face are decoded and recovered from the encoded motion vectors, achieving the goal of high-quality 3D facial video transmission while keeping the bit rate low.

- At present, the work of recovering face texture details from motion vectors **has been completed**. The results have been shown on my **personal website**.
- The extraction of motion vectors is still ongoing, but it is well worth the wait to represent a single-frame 3D face with 32 bytes of motion vector data.

✧ **Open the Anywhere Door: Characters Transfer in Mixed Reality** 06/2020 - 10/2020

Project Description: Video chats in the future will not stay on a two-dimensional screen. The best way to foresee the future is to make it. I developed a 3D live broadcast system in mixed reality, aiming to bring users a fully immersive experience in video chat.

- With this project, I **won the first prize** in the first "Huawei VR Application Development Competition" in 2020. (A total of 284 teams competed, with 4 first prize winners.)
- Due to the excellent work results, **Huawei Technologies Co., Ltd. contacted our team** following the competition, hoping to collaborate on a relevant project for further in-depth research.

✧ **Visual Switching Technology Based on Viewpoint Tracking** 09/2019 - 05/2020

Project Description: Wearing a VR head-mounted display for a long time will cause visual discomfort, including visual fatigue, dizziness, and nausea, which penalizes the quality of experience for users. Accommodation-vergence conflict (AVC) is one of the main contributors to visual discomfort. To meet this challenge, I proposed **a novel dynamic depth-of-field (DoF) rendering pipeline**, which can effectively alleviate the AVC effect in VR. Specifically, I incorporated light field refocusing, an image post-processing algorithm, into the virtual scene rendering pipeline to achieve dynamic DoF. Furthermore, taking into account the visual perception characteristics of human eyes, I used a combination of light field refocusing and viewpoint tracking techniques to dynamically render scenes into a picture that is more comfortable for users.

- **The project was displayed at the 2020 Global Mobile Broadband Forum**.

SKILLS

- **Programming:** C#, C/C++, CUDA, Python, Matlab
- **Toolkits:** Pytorch, Pytorch3D, Unity
- **Platforms:** Windows, Ubuntu
- **Mathematic Theory:** Numerical Linear Algebra (Score:95/100), Matrix Theory (Score:98.6/100), Engineering Optimization Methods (Score:97.6/100)