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EE 267: Project Proposal
Affordable Cinematic VR Content Creation

Motivation

Advances in head mounted displays and computer graphics have created a path for virtual reality (VR) headsets to become a potential standard computing platform of the future. VR has taken a strong foothold in the gaming industry due to the ease of creating computer generated content. However, there is a great demand for generating immersive environments captured from the real world. Panoramic imaging is a well established field in computer vision, and many cameras and algorithms exist to capture 360 panoramas. However, a truly immersive experience in virtual reality necessitates stereoscopic 360 panoramas. Companies like Facebook and Google have created cameras such as the Surround 360 and Jump [1] that capture 360° stereoscopic video based on the omnidirectional stereo (ODS) projection model [2]. As virtual reality becomes a standard media platform, the need to generate real world content that is visually appealing and cost effective will be paramount.

This project aims to generate real world stereoscopic 360 degree panoramas, and a viewer to render this content in a headset. Stereoscopic images as well as spatial audio of at least 2 scenes will be captured.

Related Work

Current cameras that capture 360 degree stereoscopic panoramas with spatial audio cost a minimum $10,000, and require proprietary software to process and render content. Alternatively, the Google Cardboard Camera mobile app allows users to capture static scenes using a cell phone camera. However, the results are only an approximation of the ODS projection model, with a limited sense of depth. Also, they do not incorporate spatial audio due to the limitations of microphones on mobile devices.

Google has also incorporated a VR mode on Youtube, allowing content creators to publish 360 degree video content viewable using any Cardboard compatible headset.

Our Approach

Our approach aims to create a capture pipeline that can be adapted to multiple platforms, is of lower cost compared to current capture methods, and is open source. The camera rig we will use was created for cinematic VR research, and utilizes low cost, off the shelf components. We will also be utilizing the same microphone used on the Google Jump camera, which captures spatial audio in 1st order ambisonics.

Our viewer will incorporate rotation tracking using an IMU, allowing the user to see the scene in 360 degrees with audio content that adapts to changes in gaze.

Timeline With Milestones

- May 29th:
    - Research spatial audio implementations for VR
    - Incorporate head tracking
    - Find computer generated panoramas for testing
    - Find sample spatial audio files for testing
- June 2nd:
    - Get spatial audio code working with head-tracking with sample audio
    - Prototype viewer with computer generated panoramas
- June 7th:
    - Capture sample panoramas with audio
    - Finalize code

References

[1] Anderson, R., Gallup, D., Barron, J. T., Kontkanen, J., Snavely, N., Hernandez, C., Agarwal, S., “Jump: Virtual reality video.”, *ACM Trans. Graph. 583 (SIGGRAPH Asia)*, 2016, Vol. 35, No. 6, 198:1–198:13.

[2] S. Peleg, M. Ben-Ezra, Y. Pritch, "Omnistereo: Panoramic Stereo Imaging", *IEEE Transactions on Pattern Analysis and Machine Intelligence,* March, 2001, Vol.23, No.3, pp.279-290.