Virtual Reality Motion Parallax with the Facebook Surround-360

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Motivation

Incorporating motion parallax into virtual reality (VR) can create a more convincing and comfortable VR experience. Although growing interest in VR has led to the development of 360-degree media platforms, including camera rigs and smaller handheld cameras, most systems fail to incorporate motion parallax rendering.

Systems which do support motion parallax require a complicated acquisition process or a large amount of data must be stored to render the scenes.

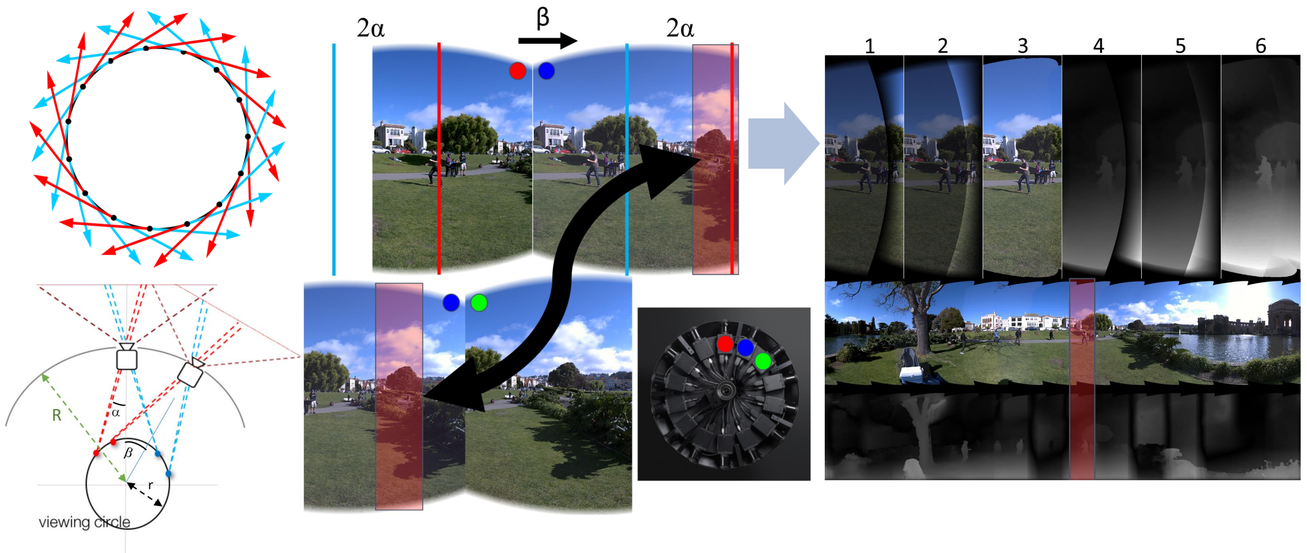
We implement a framework to capture natural scene images using the Facebook Surround-360[1] and render 360-degree stereo images with motion-parallax from an easily compressible data format.

Source: Facebook

New Technique

We alter the Facebook Surround-360 rendering code to produce DASPs with an extended stereo baseline corresponding to a larger ODS viewing circle. Motion parallax rendering is supported for eye positions within the larger viewing circle.

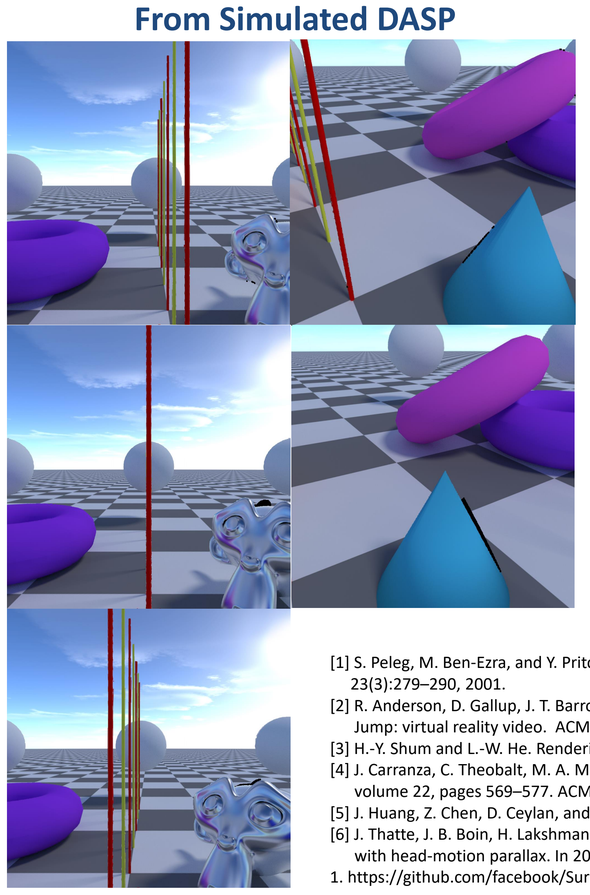
Image Acquisition with Surround-360 → Render DASP using extended stereo baseline, estimate depth from disparity → Synthesize stereo views with motion parallax using DASP



Related Work

Format/Method	Scene Capture	Data Footprint	Motion parallax
Omnidirectional stereo (ODS) panorama Google Jump [2], FB Surround-360[1]	Simple	Small	No
Concentric Mosaics [3]	Medium	Medium	Yes
Free viewpoint rendering [4]	Hard	Medium/Large	Yes
Structure from motion [5]	Hard	Medium/Large	Yes
Depth-augmented stereo panorama (DASP)	Simple	Small	Yes

Experimental Results



[1] S. Peleg, M. Ben-Ezra, and Y. Pritch. Omnistereo: Panoramic stereo imaging. IEEE Trans. Pattern Anal. Mach. Intell., 23(3):279–290, 2001.
[2] R. Anderson, D. Gallup, J. T. Barron, J. Kontkanen, N. Snavely, C. Hernandez, S. Agarwal, and S. M. Seitz. Jump: virtual reality video. ACM TOG, 35(6):198, 2016.
[3] H.-Y. Shum and L.-W. He. Rendering with concentric mosaics. In Proceedings SIGGRAPH 99, pages 299–306., 1999.
[4] J. Carranza, C. Theobalt, M. A. Magnor, and H.-P. Seidel. Free-viewpoint video of human actors. In ACM TOG, volume 22, pages 569–577. ACM, 2003.
[5] J. Huang, Z. Chen, D. Ceylan, and H. Jin, 6-DOF VR videos with a single 360-camera. In CVPR, 2017 (submitted)
[6] J. Thatte, J. B. Boin, H. Lakshman, and B. Girod, Depth augmented stereo panorama for cinematic virtual reality with head-motion parallax. In 2016 ICME, pp. 1–6, July 2016.
1. https://github.com/facebook/Surround360