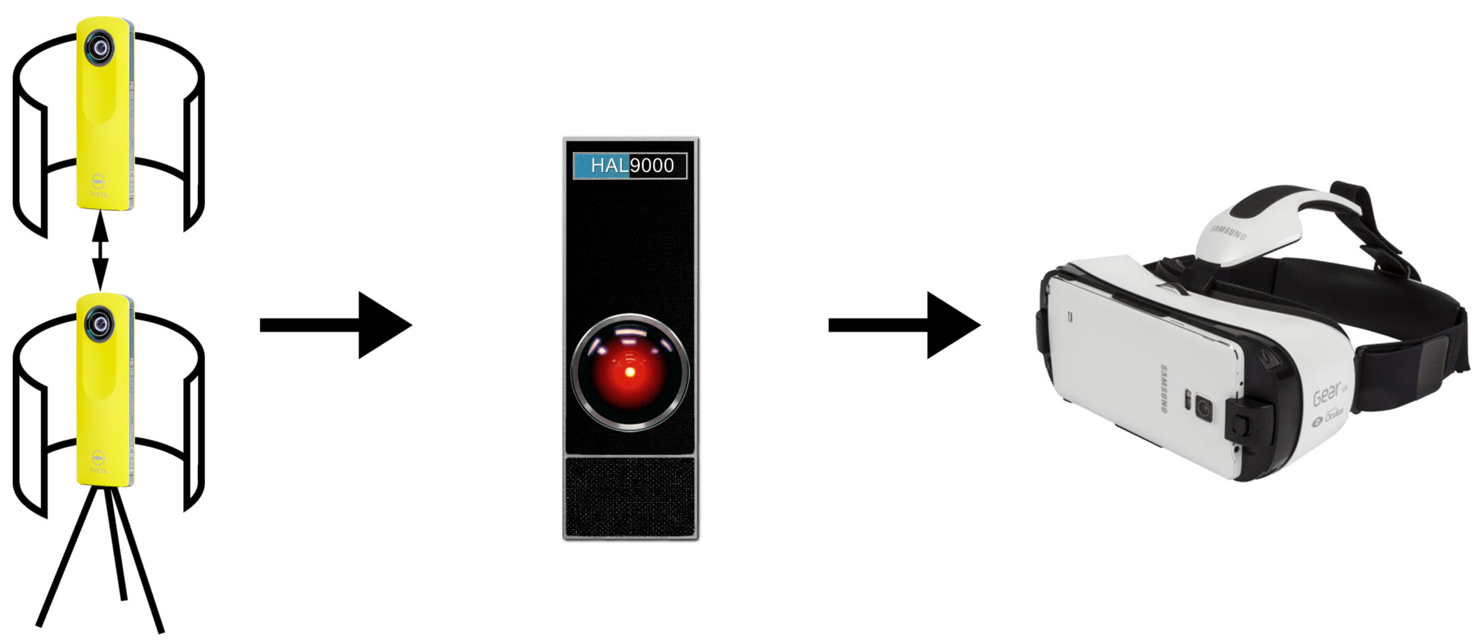
Rendering of Stereoscopic 360º Views From Spherical Image Pairs

Dash Bodington, Jayant Thatte, Matthew Hu
Department of Electrical Engineering, Stanford University

Goal and Motivation

The goal of this project is to capture vertically displaced spherical image pairs with the Ricoh Theta camera, and generate stereoscopic 360º views for the Samsung Gear VR.



Ricoh Theta
Capture vertical stereo scene information.

Processing
Extract scene information and render new views.

Samsung Gear VR
Display stereoscopic 360º information.

The system implemented in this project facilitates easy capture and review of 360º 3D video, since the entire scene is captured at once and there is minimal scene occlusion by the setup.

References

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2.Kim H., Hilton A., "3D scene reconstruction from multiple spherical stereo pairs," Int. J. Comput. Vision. 104, (1), 94 –116 (2013).
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4.Schmidt, J.; Niemann, H.; Vogt, S., "Dense disparity maps in real-time with an application to augmented reality," Applications of Computer Vision, 2002. (WACV 2002). Proceedings. Sixth IEEE Workshop on , vol., no., pp.225,230, 2002
5.Zhang, L.; Wa James Tam, "Stereoscopic image generation based on depth images for 3D TV," Broadcasting, IEEE Transactions on , vol.51, no.2, pp.191,199, June 2005

Methodology

Initial Top and Bottom Images
•Captured 360 by 180 degree panoramas using a Ricoh Theta camera at two known tripod heights

Disparity Map Generation
•Used a windowed similarity accumulator to calculate raw disparities
•Median and closing filters for small holes
•Filled in large, undefined regions.

Color Segmentation
•RGB image was segmented using chromaticity, to identify objects in the scene.

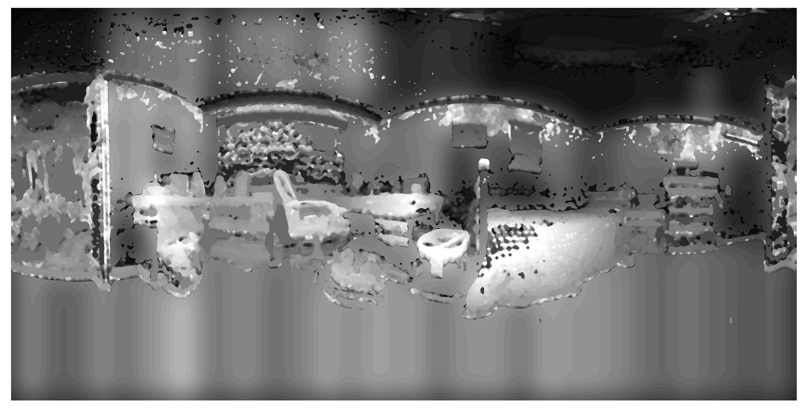
Segmentation-Based Disparity Filtering
•Disparity values were averaged over each segment generated in the previous step.

Depth Map Generation
•Converted disparity values to their trigonometrically corresponding depth values.

Stereoscopic Image Rendering
•Calculated new position for each pixel from shifted viewpoints.
•Filled image holes with depth-sensitive replication.

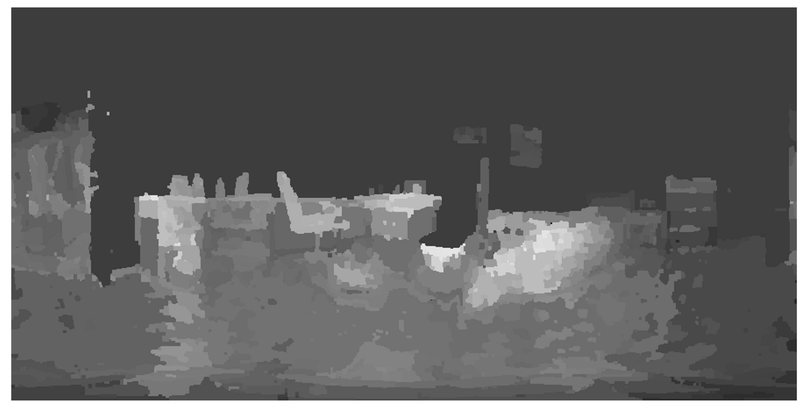
Experimental Results

Original bottom image
Image corresponding to disparity map for future distortion.

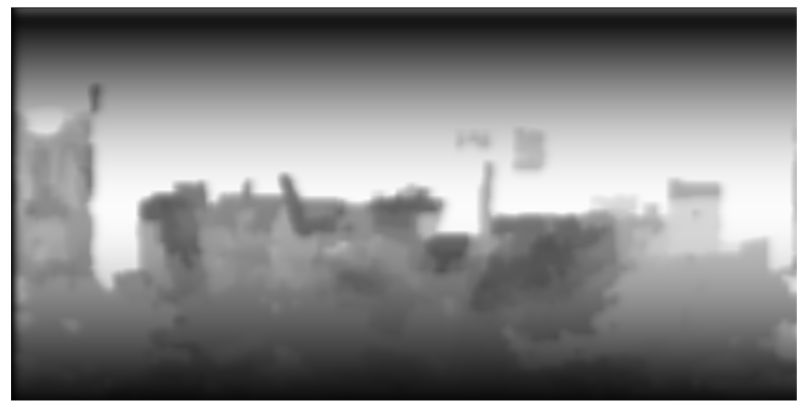


Pixel-level disparity map
Brighter pixels correspond to greater pixel shifts i.e. closer objects.

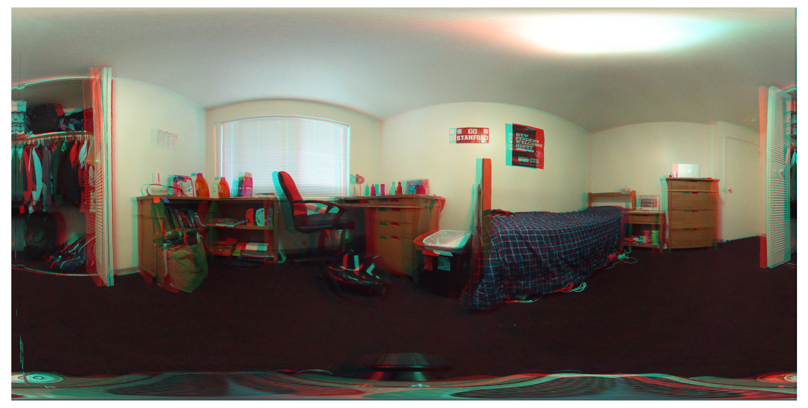
Color segmentation
Detected segments uniformly colored.



Segmented Disparity map
Disparities averaged over calculated color segments.



Depth Map
Brighter pixels correspond to greater distance.



Anaglyph Image
Both rendered views represented in different color channels.