Omni-directional stereo for 360° 3D virual reality video

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Abstract

The aim of our project is to produce omni-directional stereo images and videos, which are for example viewable in the Google Cardboard. The input for our pipeline are the images of a camera rig, which are stitched together for receiving omni-directional images. This process has to been carried out twice, once for the left and once for the right eye to get an omni-directional stereo image.

1. Introduction

The stereo view of our eyes is created by fusing the image from the left eye with the one from the right eye. This enables us to perceive a stereo impression of the world. Therefore, to produce stereo videos, we need to capture synchronized videos from two cameras set apart at interpupillary distance (IPD), which denotes the distance between the two eyes and is on average about 6.4 cm. However, the goal of this project is not only to produce stereo, but omni-directional, which means 360°, videos. The first simple idea coming in mind to capture such videos is to place two omni-directional cameras with a distance of IPD. One issue with such an approach is that the two cameras will see each other, which is undesirable. However, the more important problem is that objects lying on the line between the two camera centers will have no disparity (see figure 1). Disparity denotes the amount of shift in the image position between the left and the right eye. Therefore, this simple solution does not work and would not produce the desired omni-directional stereo videos.

The ideal solution would be to have a stereo image pair for every head orientation, for example one pair for each degree (see figure 2). However, this would be a huge amount of images. The main idea is to approximate this optimal view by only capturing the central ray of each camera instead of the full image at each head orientation (see figure 3).

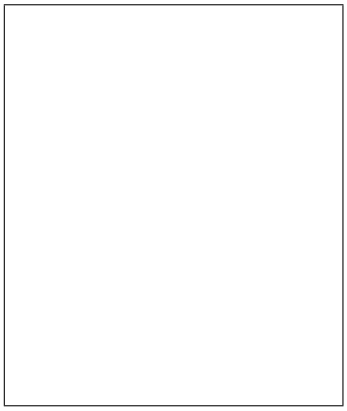

Figure 1. Illustration of two 360° cameras placed next to each other.

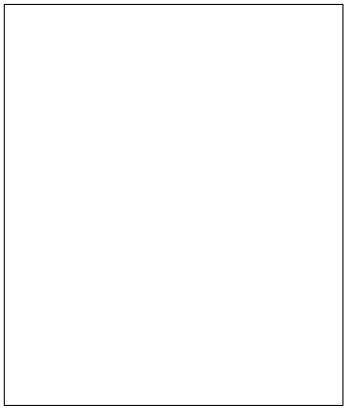

Figure 2. This image shows the most optimal situation, where a full image is captured for each head direction. The red rays illustrate the left eye and the blue ones the left eye.

2. Related work

3. Method

All text must be in a two-column format. The total allowable width of the text area is $6\frac{7}{8}$ inches (17.5 cm) wide by $8\frac{7}{8}$ inches (22.54 cm) high. Columns are to be $3\frac{1}{4}$ inches

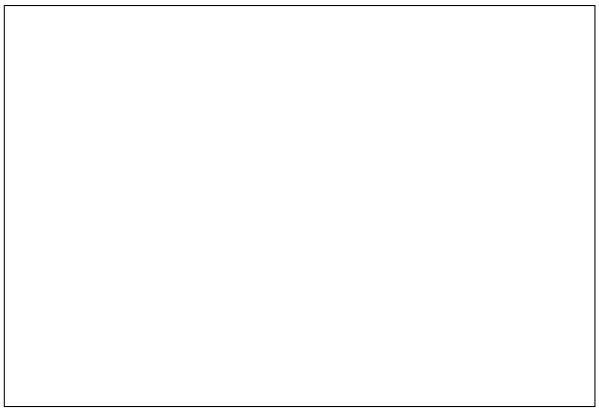

Figure 3. The left image shows the rays for capturing the full image at one head direction. The right image illustrates the ODS approximation by using only the central ray of each camera position.

(8.25 cm) wide, with a $\frac{5}{16}$ inch (0.8 cm) space between them. The main title (on the first page) should begin 1.0 inch (2.54 cm) from the top edge of the page. The second and following pages should begin 1.0 inch (2.54 cm) from the top edge. On all pages, the bottom margin should be 1-1/8 inches (2.86 cm) from the bottom edge of the page for 8.5×11-inch paper; for A4 paper, approximately 1-5/8 inches (4.13 cm) from the bottom edge of the page.

4. Results

5. Discussion

6. Conclusion