Consistent Stylization of Stereoscopic 3D Images

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Figure 1: *The right view, left view, and anaglyph of a stereoscopic image stylized using our methods.*[1]

1 Introduction

The application of stylization filters to photographs is common, Instagram being a popular recent example. These image manipulation applications work great for 2D images. However, stereoscopic 3D cameras are increasingly available to consumers (Nintendo 3DS, Fuji W3 3D, HTC Evo 3D). How will users apply these same stylizations to stereoscopic images?

A stereoscopic 3D photograph is composed of left and right views. One method to stylize a 3D photo is to apply a given filter independently to its left and right views. However, as pointed out by Richardt et al. [2011], this method introduces inconsistencies between the images which cause ocular pain.

Previous work has adapted specific stylization algorithms, such as painterly rendering, to stereoscopic 3D images [Stavrakis and Gelautz 2005]. However, there does not exist to the best of our knowledge a more general method to stylize stereoscopic 3D images. Additionally, while many existing methods for stereoscopic 3D stylization reduce inconsistencies between left and right views, they do not eliminate them. We present a method for consistent stylization of stereoscopic 3D images that works with many filters from Photoshop, and even painterly rendering algorithms such as Hertzmann's [1998].

2 Method

Given a stereoscopic 3D image composed of left and right views and a corresponding pair of pre-computed left and right disparity maps our method works as follows. First, use the disparity maps to decompose the left and right views into layers L_d and R_d, where d is a disparity value. Then, for each disparity value d, merge L_d and R_d to create a merged view M_d. Note that there are no occluded

pixels in M_d. Next, apply a stylization filter to each merged view M_d and split each image back into left and right views L'_d and R'_d. Finally, the stylized left and right views are composited into the final left and right views of a stereoscopic 3D image.

3 Results

We tested our consistent stylization approach using a variety of Adobe Photoshop filters. Many stylization filters, such as rough canvas, mosaic, angled strokes, and under-painting work well within our method, producing comfortable stylized stereoscopic 3D images. However, filters such as sumi-e and watercolor, which use global image properties, do not work well in general. Specifically, we observed that when filters use global statistics like colour, luminosity, or contrast, our final stylized image was consistent but exhibited visible layering. With small modifications to the stylization algorithm, or to the merged views M_d, the layering can be reduced or eliminated for non-stroke based filters. More involved stylization algorithms, such as stroke-based painterly rendering algorithms, may require further adjustments to reduce early stroke termination and reduce sharp edges between M_d layers [Northam et al. 2012].

We conducted a user study to evaluate our algorithm. 85% of participants found our results more comfortable to view than those of other stereoscopic stylization approaches.

References

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