3D editing tools for stereo images

Vikas Ramachandra, Kalin Atanassov and Sergio Goma
Qualcomm Inc.,
San Diego, CA
{vikasr,kalina,sgoma}@qualcomm.com

Introduction

With the advent of 3DTVs and consumer 3D cameras on cell phones, stereo 3D images and videos are set to become ubiquitous in the near future. However, at present, 2D image editing software applications do not provide for 3D editing and overlay features.
In this paper, we discuss various automatic as well as user assisted 3D editing tools for stereo images. Our main aims are to:

A. Add 3D viewing comfort (remove frame violations).
B. Add aesthetic modifications and provide for extensions of 2D image tools to 3D images. This includes annotations, text overlay, depth labeling and 3D picture in picture mode. The following examples illustrate the above ideas A and B.

1. Example 1: Drapes or photo frame objects to cover 3D frame violations (A).

It has been observed that in 3D images and videos, when there are objects at the boundary that pop out of the screen (and are only partially visible in the scene), this leads to visual discomfort to the viewers. The reason for this is that there is no analog for this in the real world, i.e. when looking at a real world 3D scene through a physical window. To avoid this, we propose adding drapes at the frame boundaries. This is achieved through the following steps:

- Determine the range of the central portion of the scene:
    - Rectify left and right images.
    - Identify keypoints in the scene. (Unique vertical edges)
    - Determine the disparities at the keypoints with a reliability measure.
    - Build a scene disparity histogram and trim its tails to remove outliers.
    - Find the max, min and range of the histogram.
- Shift the left/right images to achieve convergence at the mid range of the central portion of the scene.
- Locate keypoint regions at the boundaries which are 'popping out' (crossed disparities): frame violations.
- Build drapes for L/R images and introduce disparity for the drapes tapering from a fixed value to zero at the boundaries.
- Add drapes to cover the regions which are causing frame violations.

2. Example 2: 3D text annotation, labeling, tagging (semi automatic with user interaction) (B)

For 3D images, when users want to annotate different regions (e.g. label faces), it is useful to add the tags at the same depth as the object. This is done by building the letters on a 2D plane and adding the plane near the user selected object such that it is at the same disparity as the selected region. For this, we use the mean of the disparities of the keypoints in the neighborhood (determined by the same procedure as in Example 1.) to be the disparity of the letter plane. Applications for this are:

- Annotating, tracking regions/players in sports videos.
- Labeling faces on social networking site 3D-photos.
- Tagging landmarks in tourist 3D-photos.

3. Example 3: 3D picture-in-picture (B)

- Identify a fronto-parallel 2D 'canvas' plane in the 3D 'parent' scene (either automatically or with user interaction)
- Scale the 3D image to be inserted ('insert') to the required disparity range (if D1 is the disparity of the 2D canvas plane and D2 is the maximum pop out disparity of the 'parent' scene , scale the 'insert' scene (and shift its left and right images) such that the 'insert' scene has disparities only between D1 and D2).
- Add 'insert 'scene onto the desired 2D plane in the 'parent' scene.

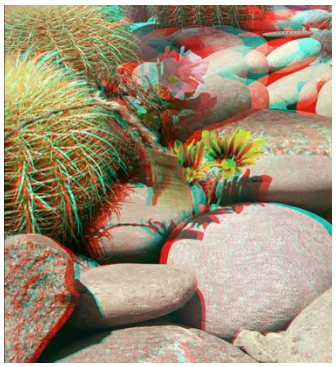


Fig. 1A



Fig. 1B

Fig 1A. Before processing.
Fig. 1B.Drapes added to avoid frame violations.



Fig.2

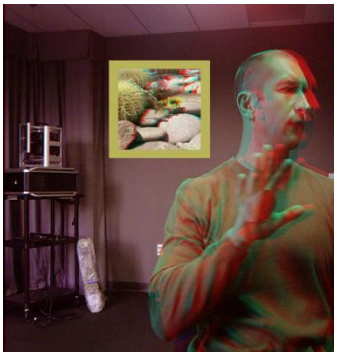


Fig.3

Fig. 2. User selected objects annotated in depth (Ex. 2)
Fig. 3. PIP: 'Stones 3D' added on the wall (Ex. 3)

Copyright is held by the author / owner(s).
SIGGRAPH 2011, Vancouver, British Columbia, Canada, August 7 – 11, 2011.
ISBN 978-1-4503-0921-9/11/0008