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Automatic 2D-to-3D Image Conversion-A Study

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Abstract: With increasing demands of 3D contents, conversion of many existing two-dimensional contents to three-dimensional contents has gained wide interest in 3D image processing. It is important to estimate the relative depth map in a single view image for the 2D-To-3D conversion technique The three-dimensional (3D) displays required the depth information which is unavailable in the conventional 2D content. Recent advances in 3D have increased the importance of stereoscopic content creation and processing. Therefore, converting existing 2D contents into 3D contents is very important for growing 3D market. The most difficult task in 2D-to-3D conversion is estimating depth map from a single-view image.

I. INTRODUCTION

With the development of 3D applications, the conversion of existing 2D images to 3D images becomes an important component of 3D content production. The conversion process of existing 2D images to 3D is commercially viable and is fulfilling the growth of high quality

stereoscopic images.

Fig.1 Example of 2image and depth map

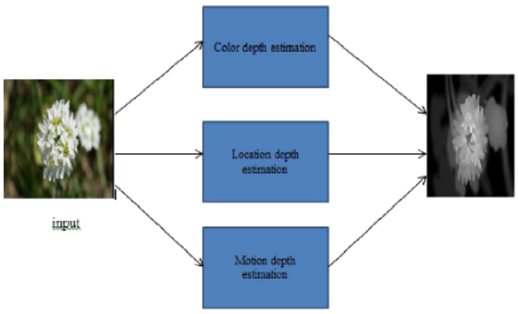

Fig2. Example of depth estimation using local method

The dominant technique for such content conversion is to develop a depth map for each frame of 2D material. When observing the world, the human brain usually integrates the heuristic depth cues for the generation of the depth perception. The major depth perceptions to be noted are binocular depth cues from two eyes and monocular depth cues from a single eye[4]. The disparity of binocular visual system helps human eyes to converge and also to accommodate the object at the right distance. Monocular cues which include focus/defocus, motion parallax, relative height/size, and texture gradient provide various depth perceptions based on human experience. Therefore, humans are able to perceive depth from the single-view image/video.

II EXISTING SYSTEM

The work here describes an efficient 2D-to-3D conversion method based on the use of edge information. Importantly, the edge of an image has a high probability as it can be the edge of the depth map. Once the pixels are grouped together, a relative depth value can be assigned to each region. Fig. 1 schematically depicts the proposed conversion system. Initially, the block-based image is considered to segment it into multiple groups. Then the depth of each segment is assigned with the help of an initial depth hypothesis. Next, the blocky artifacts have to be removed using cross bilateral filtering. Finally, multi-view images are obtained by the method of DIBR. As a result, the input 2D image is converted into visually comfortable 3D image without the presence of artifacts enhancing the quality of the image in the display

A.Block-Based Region Grouping

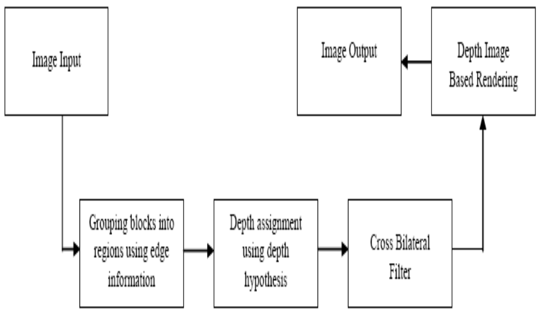

Figure 1: 2D-to-3D Conversion System

Computational complexity is reduced mainly by block-based algorithm. This implies each pixel in the same block

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has the same depth value. A 4-by-4 block is used as an example. Each node is a 4-by-4 pixel block, and is four-connected. The value of each link is calculated by considering the absolute difference of the mean of neighboring blocks: Diff (a, b) =| Mean (a) − Mean (b) |

B.Depth from Prior Hypothesis
The extraction of depth is the crucial one in the conversion process. The greatest difference between 2D and 3D image is the depth information. The object can jump out of the screen and look like a real life due to the depth information. If we extract these depth signals and integrate them together, we will build a strong foundation to make 3D images of better and higher quality. The depth generation algorithms are roughly classified into three categories which utilize different kinds of depth cues: the binocular, monocular and pictorial depth cues. Each signal represents different depth information.

C.Bilateral Filtering
The bilateral filter is non-iterative and also achieves satisfying results with only a single pass. This makes the filters parameters relatively intuitive as their effects are not cumulated over several iterations. The bilateral filter has proven to be much useful although it is slow. It is nonlinear and also its evaluation is computationally expensive because the traditional accelerations like performing convolution after an FFT are not applicable. Nonetheless, solutions have been proposed later in order to speed up the evaluation of the bilateral filter.

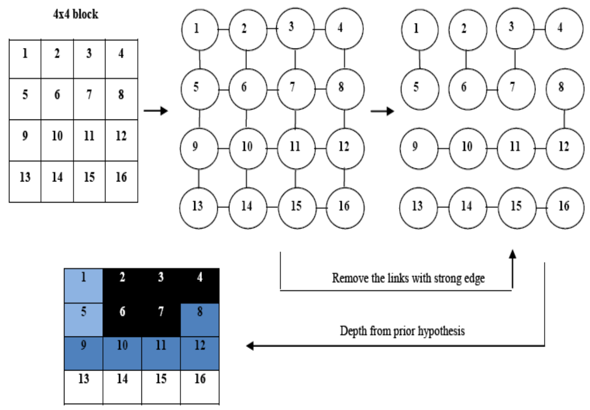

Fig.2.Depth Image Based Rendering

Unfortunately, these methods seem to rely on approximations that are not grounded on firm theoretical foundations applications like computational photography; it is often useful to decouple the data to be smoothed to define the edges to be preserved. The chosen cross bilateral filter is a variant of the classical bilateral filter. This filter is used to smoothen the image to locate the edges to preserve. The depth map generated by block-based region grouping contains blocky artifacts. Here, the blocky artifacts are removed by using the cross bilateral filter, as expressed in the equation. Where u (xi) denotes the intensity value of the pixel xi, Ω (xi) represents the neighboring pixels of xi, N (xi) refers normalization factor of the filter coefficients and Depth f is the filtered depth map. The cross bilateral filter here finely smoothens the depth map while preserving the object boundaries [9], [13]. The blocky artifact in the generated depth map is effectively removed while the sharp depth discontinuities along the object boundary are preserved.
The filtered depth map has a comfortable visual quality because the cross bilateral filter generates a smooth depth map inside the smooth region with similar pixel values and preserves sharp depth discontinuity on the object boundary. Following filtering by the cross bilateral filter, the depth map is then used for the generation of the left/right or multi-view images using depth image-based rendering (DIBR) [14] for 3D visualization

Pre-processing of depth image
Pre-Processing of depth image is usually a smoothing filter. Because depth image with that of the horizontal sharp transition may result in big holes after warping, smoothing filter is applied to smooth sharp transition to reduce the number of big hole. However, if we blur the depth image, we will not only reduce big holes but also degrade the warped view because the depth map of non-hole area is smoothed.

3D Image Warping
3D image warping maps the intermediate view pixel by pixel to left or right view according to the pixel depth value. In the other words, 3D image warping transforms the location of pixels according to depth value. The 3D image warping formula is as following:

Hole Filling
Average filter interpolation method is a common method for Hole-Filling in DIBR. However, using average filter would result in artifacts at highly-textured areas. Besides, hole-size in DIBR is so huge such that it is needed to using average filter with large window size. At the same time, the average filter with large window size is unable to preserve edge information for the reason that edge information is blurred

III. CONCLUSION
A simple depth hypothesis is adopted here to assign the depth for each region and a cross bilateral filter is subsequently applied for removing the blocky artifacts. Our future work includes extending the current algorithm to deal with more general images and sequences by combining additional cues.

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