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REAL 2D-TO-3D CONVERSION USING EDGE INFORMATION

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ABSTRACT

Although three-dimensional (3D) Enhance the visual quality displays more than two - dimensional (2D) displays, 3D displays information necessary depth is not available in conventional 2D content. Therefore, the 2D to 3D video conversion has become an important issue in the development of 3D applications. Our paper presenting the novel algorithm which automatically converts 2D movies into 3D ones .The proposed algorithm uses the edge information of the object image segment groups. A depth map is based on a deep crack gradient allocated hypothesized model. Further, the depth map is block - based allocation through cooperation with a cross bilateral filter generate depth maps efficient and comfortable visual artifacts also reduce the block. A multi -view video can be easily generated using a method based on image rendering depth one.

Key words: generation of Depth map, conversion from 2D to 3D, 3D video, bilateral filter.

INTRODUCTION

In visual processing 3D video processing has received considerable attention. Advances to 3D display technology, people aspire to experience more realistic 3D effects and unique. In addition to generating the best viewing experience that conventional 2D displays , 3D displays have many applications development , including broadcasting , movies, games, photos , video cameras , and education.

Among the several methods, it is capable of generating the 3D content includes depth sensor, vision and make 3D stereo triangle. Active methods using the active sensor such as structured light and the time of flight sensor (Gokturk, 2004), to attract depth maps. Triangle vision of stereo requires the multiple cameras to record the content. The above methods require special equipment, that are the only excellent in generating the new content, making them impossible to 2D content .2D content that requires more time depth information manual editing became an obstacle to mass market , the need to develop an effective 2D to 3D process.

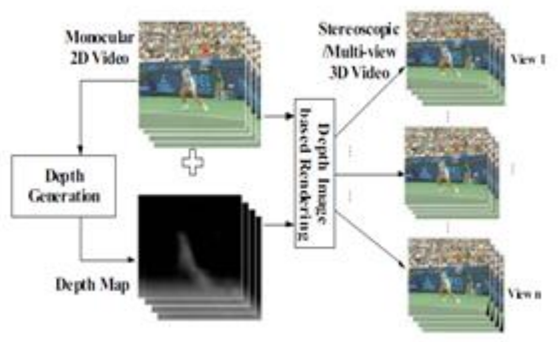

Fig. 1. A Typical conversion flow of 2D to 3D video.

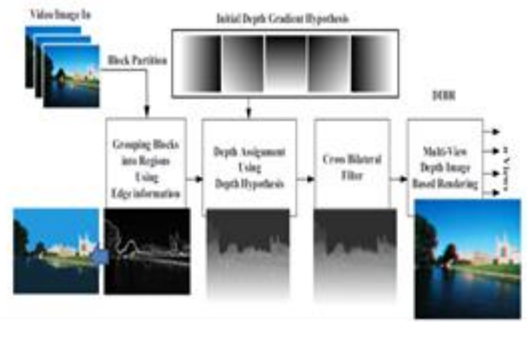

Fig. 2. Proposed 2D-to-3D conversion system.

A typical 2D - 3D conversion to which automatically generates detailed information from a single view picture / a video multi with the view of the image / video user estimate depthful maps is shown in Fig. 1. When observing the real world, the human brain integrates different depth cues heuristic to generate depth perception. Perceptions great depth Binocular depth cues are two eyes and monocular depth cues from one eye. The difference binocular system helps the human eye to converge and accommodate remote object itself. Eye indices, which includes the focus / de-focus, motion parallax, and the relative height / size, and quality gradient, we offer different depth perception based on human experience. Therefore, people can perceive depth from a single view picture / video.

The depth map generation methods can be mainly classified into mono and multi- frame - frame methods. The methods include single frame decor depth using image classification, machine teaching (P. Harman, 2002), the depth of focus / defocus (Park, 2006), the depth of geometrical perspective (Tsai, 2006), depth gradient quality and depth altitude relative. Battiato generating the depth maps uses multiple cues from a single image. Depth is assigned based on object properties in different regions. Hoiem maps generated using machine learning algorithms. Depth scene and object are assigned based training. However, the above methods are not reliable for missing cases during the training phase. Method estimated depth image (CID) -a single image divided into several sub- blocks and contrast and the unclear information that used to generate depth information for every block. Park et al. to determine the distance from the focal plane using reduced blur depth - of - field optical physics. Depth of Focus and defocus methods to estimate the depth of edge blur range are feasible only for depth - of - field images of small and low depth maps generate accurate.

Depth gradient scenes made using the point of extinction. Jung et al. some depth maps using depth information and prior knowledge edge. Although capable of using different depth cues monotonous and suitable for various occasions, these methods are reliable single frame when selected indices are weak in the input image. Moreover, over one - frame methods to process each frame individually without considering the coherence time and cause vibrations in depth maps.

Methods based on many - include stereo vision triangular frame / multi -view motion and depth. Depth of motion parallax is a temporary connection to vision triangle. Correspondence relative frames / views are estimated to take deep inequality. In the depths approaching motion parallax, motion vector required depth them (MV) is converted into inequality vector (DV). Another approach, modification time difference method (DMT), generates stereo pair without a depth map. While modified frame pairs the difference, are selected as the left - eye and the right eye images for the generation of a stereoscopic effect. However, the depth of motion parallax method camera not any movement. A hybrid integration feel the CID was developed in. To our knowledge, this is the first work that considers both monocular and binocular cues.

2D - 3D depth to- generation algorithms generally faced with two challenges. A deep image of the same object or the video format of 2D pixel array, information about the group on the subject of missing pixels. Better group of pixels means a better outcome for uniformity deep inside the plant. An effective method of group should consider the similarity of color and spatial distance. Another challenge lies in taking a deep relationship between all objects appropriate. Generating a 2D depth map of a person is a bad problem posed. Not all depth cues can be taken from a picture for making two or more consecutive frames.

To rectify this two challenges, this method presents an optimized algorithm which uses a simple hypothesis deep depth assign each group instead of recovering depth cue directly from the depth value. First, the proposed algorithm selects an effective method to group the pixels group have similar color and spatial locality. The depth values are set according to the depth value hypothesis. Cross bilateral filter is applied to enhance visual comfort. The experimental results suggested algorithmic can generate promising results with lesser side effects.

The rest of the method is organized as follows. The Section II describes an automated 2D to 3D conversion using the edged data to generate the depth map method. Section III then summarizes the experimental results. A deepest analysis of complexity of computational and visual quality is also discussed. Finally conclusions are made in Section IV, together with recommendations for future research.

PROPOSED SYSTEM

This describes a 2D - 3D conversion based with the optimum method using edge information. Mainly, the edge of an image with a high probability of the depth map. When the pixels are grouped, a relative value of depth can be assigned to every region. Fig. 2 shows schematically the conversion of the proposed system. Initially, the image is segmented basic block into several groups. The depth of every segment is then secured with a deep initial hypothesis. Further, blocky object is removed using bilateral filtering cross. Finally, multi- Show images are provided by imaging depth - based (Debar) and a display screen in 3D.

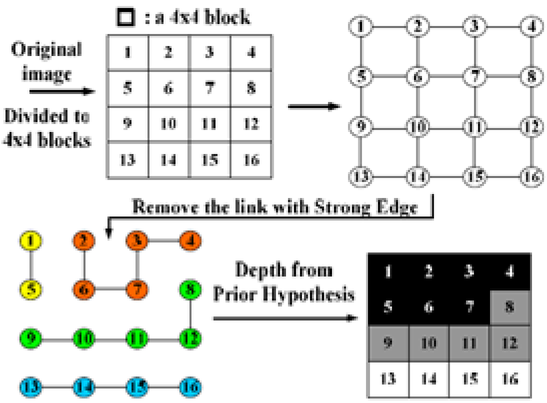

Fig. 5. Flow of block-based region grouping.

Block-Based Region Grouping

Fig. 5 shows the flow block group using edge information. The calculation complexity is reduced by using a block based algorithm that means that every pixel in the same block has the equal depth value. A 4 -By - 4 chart was used as the example. Each node is April 1 -by - block of four pixels, and every node is 4 - connected. The value of each connection is assigned as the average absolute difference of neighboring blocks:

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Where a and b show two neighboring blocks, respectively, and the average (a) is the average color EA. This value measures the resistance similarities neighboring blocks. A lower value means a higher similarity between the two blocks.

After calculating the average absolute difference of neighboring blocks, the blocks are divided into several groups, and minim stretch segmentation tree. Initially, a minimum spanning tree (MST) was built. Strong links have been removed edges to generate several regions grouped. Specifically, the MST algorithm is used to identify the consistency between the two blocks.

Table I: Pseudo Code Of Segmentation Using The Minimum Spanning Tree

```
Minimum Spanning Tree Segmentation()
  initial: T = {}
  while T does not form a spanning tree:
    find the smallest edge in E that form a spanning tree for T
    T = T union (E)
  sorting the edges in T by the edge strength
```

Color difference without generating several small groups. MST algorithm that maintains connection based link has an extreme result in spatial locality. Table one shows the pseudo code. The mandatory effective conservation property, spanning tree segmentation method can generate minimum group excellent results . Generation algorithm proposed depth can be also replaced by other automatic or manual segmentation group with satisfactory results.

Depth of preliminary hypotheses

After generation of block groups, each block is given the appropriate depth of depth gradient hypothesis. When any change is detected scene in the linear perspective of a scene is processed by an algorithm using Hough transform line detection (Cheng, 2009). Initial ball gradient hypothesis is based on information obtained linear perspective, as shown in Fig.5.Vlera depth of a given group R block is assigned :

$$Depth(R) = 128 + 255\left\{\sum_{pixel(x,y)\in R} W_{rl}\frac{x-\text{width}/2}{\text{width}} + W_{ud}\frac{y-\text{height}/2}{\text{height}}\right\}/\text{pixel\_num}(R), \quad (2)$$

where $|W_{rl}| + |W_{ud}| = 1$.

A larger amount of deep - set means a pixel closer to the user. The above equation suggests certain depth several is the center of gravity of a block group, explaining, why where each block group belonging to the same depth value. The whole value and sign WRL and adjustable weight from left to right and top end to depth gradient. Depth hypothetical slope orientation can be derived from the analysis of a real world. Linear method fails to detect scene mode, the bottom-up method is selected as default.

C. Using the 3D View image filtering and image depth bilateral - based reflection

Depth map generated by basic circuit block group contains blocky artifacts. Here, blocky artifacts are removed using cross bilateral filter expressed in the following equation:

$$Depth_f(x_i) = \frac{1}{N(x_i)} \sum_{x_j \subset \Omega(x_i)} e^{-0.5\left(\frac{|x_j - x_i|^2}{\sigma_s^2} + \frac{|u(x_j)-u(x_i)|^2}{\sigma_r^2}\right)} Depth(x_j), \quad (3)$$

$$N(x_i) = \sum_{x_j \subset \Omega(x_i)} e^{-0.5\left(\sigma_s^{-2}|x_j - x_i|^2 + \sigma_r^{-2}|u(x_j)-u(x_i)|^2\right)}, \quad (4)$$

Where u (x) indicates the intensity of the pixel xi, (xi) is the neighboring pixel xi , N (x) refers to the normalization factor of the filter coefficients and the filter depth. Set window size depends on the stage of full block group base block - region. In implementing the kernel that, proposed bilateral filter which is larger than the full block size. Bilateral filter smoothes his depth map conservation edges of objects (Tomasi, 1998) (Paris, 2006). Fig. 5 shows an example of a filter. Blocky object depth map generated is efficiently removed, while the sharp cutting depth along the stored object. Depth filter has a comfortable visual quality filter peaceful bilateral cross generating a depth map in tranquil , with similar pixel values and preserves sharp cutting depth over the object . After filtering the cross bilateral filter, the depth map was used to generate the left and right or more - see images Debar (Chen, 2005) for visualization of 3D. Fig. 7 shows the mathematical formula of Debar. The difference can be calculated based on information known depth. Depending on the configuration of 3D displays, for example, stereoscopic or have more - view images from different angles can be generated easily view the image with color and depth maps using Debar.

EXPERIMENTAL RESULTS

Fig. 8 shows some experimental results, including data on new sets of original images, detailed maps and images of cyan cube. The proposed method generates excellent quality and visual comfort, because not limited to horizontal tracking line. 2D group proposed method gives nice results than the other single view algorithm, in particular in the building standing vertically, as shown in Fig. 8 (b). Unlike conventional motion -based algorithm (Cheng, 2009), and generating a depth of multiple frames, the proposed method uses only one image with fewer side effects. For translational motion video camera motion parallax depth can generate better quality depth. However, the camera moves are not always in the ideal settings. However, consistency temporarily depth map has a problem, proposed uses spatial information only group of blocks, resulting in some deep playful video case. Experimental results show also that the images violate initial hypothesis still generates the acceptable quality, such as that shown in the Figure 8 (h). Views the generation of stereo image was still lesser visible.

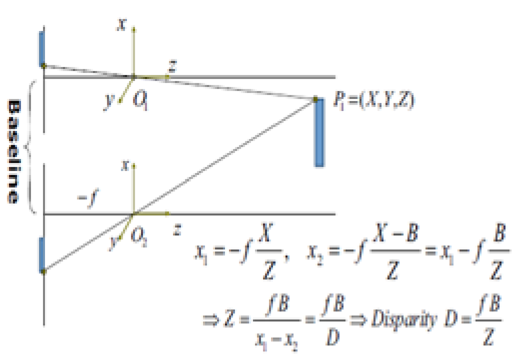


Fig. 6. Equations of depth and disparity mapping for depth image-based rendering.

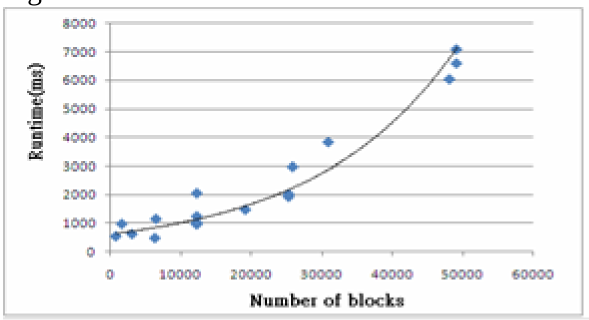
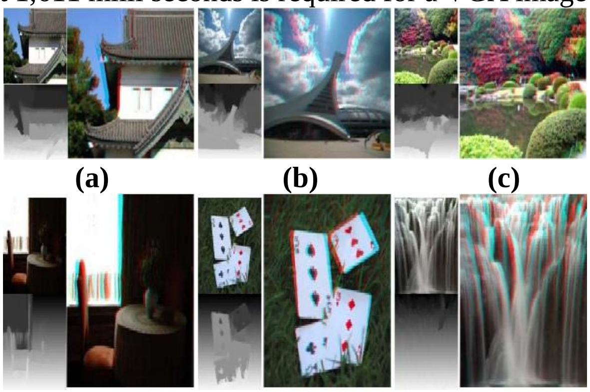


Fig. 7. Complexity curve of Computational number of blocks versus runtime.

Table II: Runtime and Subjective View Score of 9 Sample Images

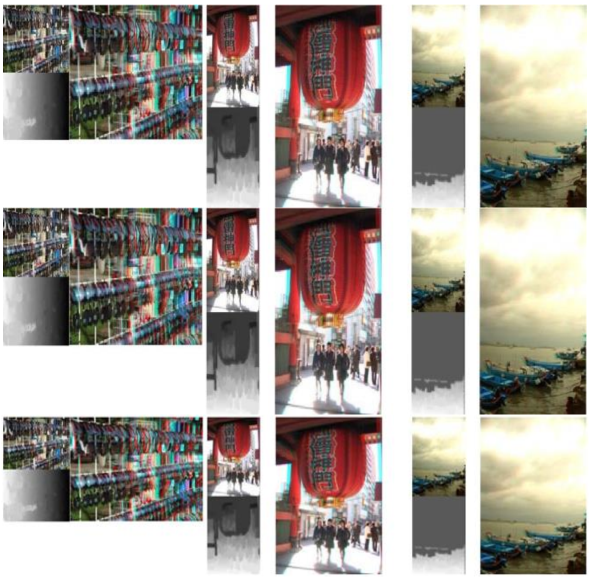
Block size	2x2	4x4	8x8	16x16
Average Runtime (ms)	39968	5250	1140	968
Average Subjective View Quality	80	78	52	

For future analysis, the following sub- sections discuss the computational complexity and depth visual analysis of video quality. A. Computerized Complexity Analysis This section analyzing the computational complexity of the new algorithm. When applied to Intel ® Core ™ 2 Duo CPU E-6850@3.00 GHz, the new algorithm can achieve SDTV720x576 0.53fps size when using 4 X 4 blocks. With a greater block size, the new algorithm has a shorter time than smaller block calculation. However, a larger block size means lower quality depth map. Table II shows the subjective, recorded according to the block size. Computational complexity of the algorithm is O (E5E - 5N), n was the number of blocks. This finding was implies in the larger number of blocks in a computer involves more time MST algorithm has a lot according to the following. Fig. 7 shows some experimental results due time to the number of blocks. Runtime 8 set of test images were collected at different block sizes. Approximate running time is 617e5E - 5N. For example, about 1,611 milli seconds is required for a VGA image



(a) (b) (c)

(d) (e) (f)



(g) (h) (i)

Fig. 8. Experimental results.

4x4 BLOCKSIZE using the proposed algorithm. Frame rate is 0.62 fps. For the same video resolution, which in a previous paper (Cheng, 2009) is about 0.1 ~ 0.2 fps and the resolution of the complexity of real movement evaluation. The proposed method selects a hypothesis simple as a suggestion rather deep integration of computers overall depth cues. Saving Strategy execution and provides minor side effects. The proposed algorithm Runtime is the, well defined prototype that can be improved further in terms of implementation or GPU parallel computing.

Visual quality analysis

This also praised the visual quality of the proposed algorithm comparing the data types of the four videos , video clips , namely that were captured by a stereoscopic camera, left view of a stereo camera is used to generate depth maps the proposed algorithm, previous work (Cheng, 2009) . This commercial the software. The incentives consist of six videos. Four sequences 720x576, Jojo, Barden, fuss ball, and Kirchweih made two DCR - PC - 8 rooms and two sequences encoding MPEG – Multi See, Akko & Kayo Flamingo and were used to make subjective point of view evaluation. Both depth and visual comfort quality are estimated using a single stimulus presentation method is a lightly modified version of the described in ITU-R-BT-500-10. Overall performance is subjectively evaluated stereoscopic video by comparing stereo video capture stereoscopic video that is generated in terms of original stereoscopic video left. Synthesized images were displayed in two -view, 120Hz display 3D Active Shutter glasses

Subjective evaluation was performed by 15 people with visual acuity and stereo acuity -to- exactly normal or normal. Participants stereoscopic watching the videos in a random order based thing and were asked to rate every video, that based on two factors, where the depth of best quality and the best visual comfort. The quality of the depth of quality is estimated on the basis of a segment of five degrees, as shown in Fig. 11 (a), and that visual comfort is estimated to Fig. 11 (b). Fig. 11 (a) and (b) indicate the values of the two factors with the sequences obtained from six experiments of evaluation.

In -depth quality, regular motion sequences, eg, sequence Fussball Jojo and depth is smooth and has an effective extension into force (Cheng, 2009) proposed algorithm. Regular movement means seobjekti has a simple move in the same direction. For example, in Fig. 11 football players in order Fussball not given enough depth assignment method provides only a relative depth pop -up on the premises on foot.

If the objects are themselves complex movements, with motion based algorithms, such as (Cheng, 2009) generates non continuous ball and makes the viewer feel uncomfortable, as shown in Fig. 13. For example, Flamingo movements, equipment and body of a dancer changes in direction and speed. Circulation curved vector value is not associated with depth due to movement of the object itself moves, the proposed algorithm performs better than algorithms based motion and generates a depth map comfortable. The same phenomenon can be observed in Kirchweih standing horse. As a result, the visual comfort, previous methods.

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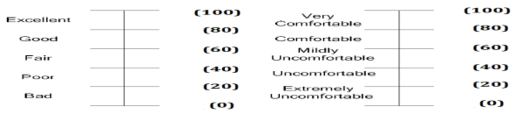
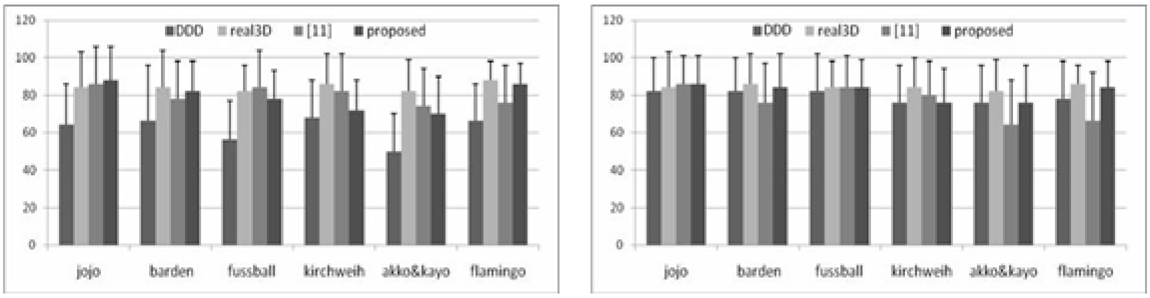


Fig. 11. Rating scales used for evaluation (a) depth quality, and (b) visual comfort.



(a)Depth quality **(b)Visual comfort**

Fig. 11. Subjective evaluation results.

Fig. 11. Comparison of generated depth maps in fussball sequence.

In (Cheng, 2009) looks worse in this case. Even the proposed algorithm times stronger effect than the algorithm based on motion, depth current conservative method is also less side effects. Specifically, the original video stereoscopic not always the highest score in the comfort room visually ways , for example , basic camera , focal length and angle convergent configured not as good as the human visual system. Moreover, when images change in lighting, motion estimation results not due to incorrect matching. The proposed algorithm works even in this case, as shown in Fig . 13. This is because some of them depend only on the spatial location of the segment. Finally, Fig . 13 show some examples of cyan stereoscopic images cube certain assessment test.

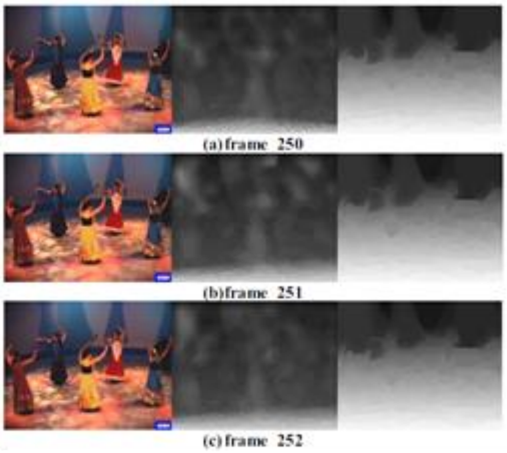


Fig. 13. Comparisons of detailed maps Flamingo sequences in frame to frame 250 252.

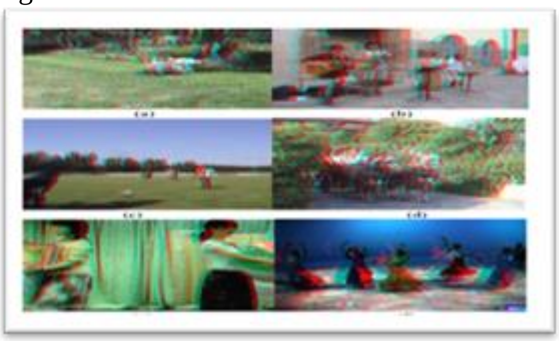


Fig. 14. Red-Cyan images of six test sequences, (a)jojo, (b)barden, (c)fussball, (d)kirchweih, (e) Akko&Kayo, (f) Flamingo sequences.

CONCLUSION

This presented a 2D - 3D conversion algorithm in- novel. The proposed algorithm uses the edge information of the image into regions of coherent group. A simple hypothesis depth to be approved for certain depth for each region and cross bilateral filter is then applied to remove blocky artifacts. The proposed algorithm is quality - scalable depending on the block size. Smaller block size will result in better detail deep and large block size will have lower computational complexity. The ability to generate a 3D effect comfortable, the proposed algorithm is very promising for applications of 3D conversion 3D 2D.

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