International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249 – 8958, Volume-5, Issue-6, August 2016

An Efficient Depth Segmentation Based Conversion of 2d Images to 3d Images

Geethu S S, Sreeletha S H

Abstract— In the 3D consumer electronics world have a wide increase in demands of more and more 3D technology, so this has led to the conversion of many existing two-dimensional images to three-dimensional images. The depth is an important factor in the conversion process. Determining the depth for a single image is very difficult. There are many techniques widely used for the depth estimation process. In this paper we propose an automatic depth estimation technique. Firstly, we partition the image using graph cut segmentation method. The main goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. Then we construct a higher order statistics map. The HOS is mainly used for solving detection and classification problems. We can estimate depth map from HOS mean. Finally, creating left view image and right view image and combined with depth map to generate an enhanced stereoscopic image.

Index Terms—2D to 3D, Segmentation, Graph cut, HOS, Filtering, Stereoscopic image.

I. INTRODUCTION

The 3D image has application in several fields, such as design, entertainment, manufacturing, defense, security, construction, medical, medicine and visual aid. The stereoscopic images are also called 3-dimensional images. It provides more information than 2-dimensional images. The stereoscopic images evolved early in 1860s with a nature scene taken at Boston using side by side. Stereoscopic photographs were painted by Jacob spoel, before 1868. In 1980 A. Fuhrmann developed a multi-station viewing apparatus with sets of stereo slides. French physicist Louis Ducos du hauron invented the red and blue 3D glasses used to transform 3D images in magazines, newspapers etc [1].

The conventional 2D content does not provide the depth information which is required for the 3D displays. The most important and difficult problem in 2D to 3D conversion is how to generate or estimate depth information using a single image. Several method methods have been proposed to estimate depth from a single image. A typical 2D to 3D conversion process mainly consists of two steps. Depth estimation from a 2D image and depth based stereoscopic generation. Depth map indicate distance. The high intensity indicates closer distance, while a low intensity indicates a far distance from camera. There are mainly two methods for determining the depth. One is Automatic and another is Semi-automatic. In automatic method a computer algorithm perform whole estimation process. In Semi-automatic method a skilled operator assign depth to various part of an image.

This paper proposes an automatic technique to estimate depth information from a single view image. The paper is organized as follows. Filtering is used to remove the blocky artifacts from the images and also remove the noise. Image segmentation is the process of partitioning digital image into multiple segments. The main goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate object boundaries such as lines, curves etc. Higher order statistics (HOS) is an efficient tool to measure the amount of higher frequency components in the regions. The focused regions have high frequency components. The degree of focused region is increased when the defocused region is far from the viewers. Depth value is assigned depending on the HOS mean. Image smoothening is used to reduce the artifacts and shows good performance. The stereoscopic image generation, create left view and right view image and combined them to produce a visual quality enhanced 3D image.

Revised Version Manuscript Received on August 10, 2016.

Geethu S S, M.Tech Scholar, Department of Computer Science and Engineering, LBS Institute of Technology for Women, Poojappura, Trivandrum, India.

Sreeletha S H, Associate Professor, Department of Computer Science and Engineering, LBS Institute of Technology for Women, Poojappura, Trivandrum, India.

II. PROPOSED METHOD

Figure shows the overall procedure for the proposed 2D to 3D conversion technique.

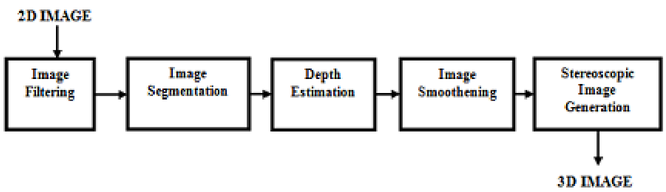

Figure 1: 2D to 3D Conversion process

A. Image Filtering

Image filtering is used to remove the unwanted things from images. Cross Bilateral Filtering is used.

Cross Bilateral Filtering

A bilateral filter is an edge-preserving and noise smoothing filter. The intensity value at each pixel in an image is replaced by a weighted average of intensity values from nearby pixels. This weight is based on a Gaussian distribution crucially the weights depend not on Euclidean distance but also on the radiometric distances. This preserves sharp edges by systematically looping through each pixel and adjusting weights to the adjacent pixels.

B. Image Segmentation

The process of partitioning the digital image into multiple segments is called image segmentation. The segmentation process is used to simplify or change the representation of an

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.

image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries such as lines, curves etc. In this paper the graph cut segmentation is used for image segmentation. does not apply in many cases, which constraints the utilization of this depth cue in 2D to 3D conversion. In many papers described here machine-learning techniques have been used to automatically estimate the depth map from a single monocular image [10][15].

Graph Cut Segmentation

The graph cut can be employed to efficiently solve a wide variety of low-level computer vision problems, such as image smoothing, the correspondence problem and many other computer vision problems that can be formulated in terms of energy minimization. Such energy minimization problems can be reduced to instances of the maximum flow problem in a graph. Under most formulation of such problems in computer vision, the minimum energy solution corresponds to the maximum posteriori estimate of a solution.

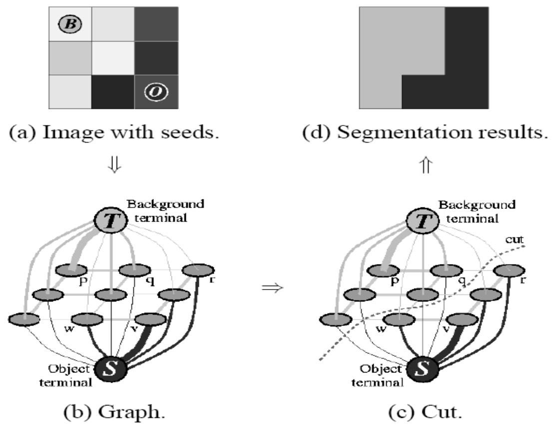

Figure 2: Graph Cut Segmentation

Although many computer algorithms involve cutting a graph (e.g. normalized cut), the term graph cut is applied specifically to those models which employ a max-flow / min-cut optimization. Binary problems such as a de-noising a binary image can be solved exactly using this approach. In images more precise image segmentation is process of assigning a label to every pixel in an image such that pixel with same label share certain characteristics[14].

C. *Depth Estimation*

Estimating depth from a single view image we use HOS map. Apply masking to segmented image for classifying the regions into foreground and background and allocating depth value for each region. The depth estimation process is discussed in the following subsections [13].

Figure 3: Depth Estimation Process

HOS is an efficient tool for measuring the amount of high frequency components in the regions. The focused regions tend to have high frequency components, but the defocused regions have fewer high frequency components[11]. The degree of defocus tends to increase when the defocused region is more apart from the viewers. To measure this change of the strength of blur in the defocused regions, we compute the mean of HOS value for each background region rob_i. Let HOS(x,y) denote the HOS value at (x,y). The mean of HOS values in R_i, $Mean_i$ can be obtained.

$$Mean_i = \frac{\sum_{(x,y)\in Ri} HOS(x,y)}{Card(Ri)}$$

Based on the above equation, the region with higher HOS mean value is considered as the less blur strength and can be determined as a closer region to the viewers than other regions. The regions with lower HOS mean can be assigned lower depth values. After determining the HOS mean, we compare these HOS mean values and assign depth_order for each background region, where *1* depth_order N_{BR}. depth_order is assigned depending on $Mean_i$. The region has higher HOS mean, depth_order is set to N_{BR}, while a region which has the lowest HOS mean is set to one. We also need to define a step size between depth values for assigning depth value to each region in BR as follows.

$$depth\_order = 255/N_{BR}$$

Where $depth_i$ is allocated depth value for a region in BR.

D. *Image Smoothening*

The discontinuities of depth value between adjacent regions can cause artifacts when the stereoscopic pair is generated. In order to reduce such artifacts, the process to smooth the estimated depth map is needed. Applying asymmetric Gaussian smoothening to the depth map shows good performance over smoothing methods[10].

E. *Stereoscopic Image Generation*

We consider the input image as the center view of stereoscopic pair. We shift each pixel of the input image by the amount of parallax(x,y)/2 to right direction to generate the right-view image. The left view image can be obtained by the same process[12].

III. Result

The figure shows the whole experimental result of the proposed method.

Figure 4: (a) 2D Input image (b) Depth map (c) 3D Image.

IV. Performance Evaluation

We have tested the proposed method using the Middlebury stereo dataset 2014. The accuracy of the methods is evaluated using the dataset samples. Different samples were tested. Table I shows experimental results obtained from the dataset samples using existing and proposed methods.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.

Table 1 : Accuracy

METHOD	ACCURACY		
	SAMPLE 1	SAMPLE 2	SAMPLE 3
EXISTING	70%	80%	85%
PROPOSED	84%	88%	90%

A bar graph is plotted using table 1. This graph shows that the accuracy of proposed method is higher than the existing method.

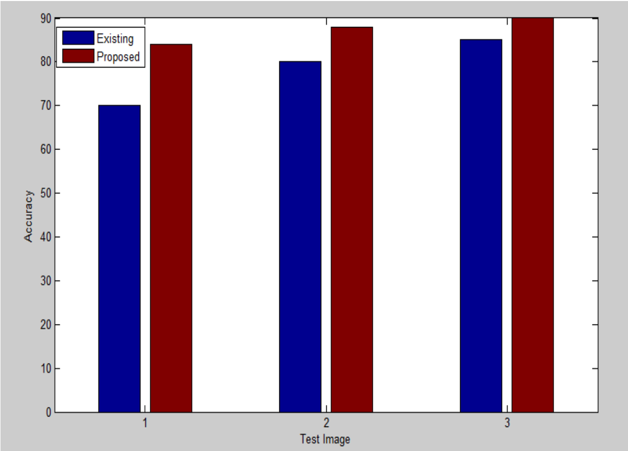

Fig 5: Performance evaluation

V. CONCLUSION

We propose an automatic method to generate a depth map from a single view image. Segment the input image using graph cut method. Then apply filtering to the segmented image. We compute the HOS mean and estimate the depth map. Using the depth map generate left and right view images. Finally the stereoscopic image is generated. This proposed method produce 3D image which is suitable for single image 3D application.

ACKNOWLEDGMENT

We are greatly indebted to our principal DR. JAYAMOHAN J, Dr. V. GOPAKUMAR, Professor, Head of the Department of Computer Science and Engineering, Ms. SREELETHA S.H, Associate Professor, Department of Computer Science and Engineering, LBS Institute of Technology for Women who has been instrumental in keeping my confidence level high and for being supportive in the successful completion of this paper. We would also extend our gratefulness to all the staff members in the Department; also thank all my friends and well-wishers who greatly helped me in my endeavor. Above all, we thank the Almighty God for the support, guidance and blessings bestowed on us, which made it a success.

REFERENCES

1. Saravanan Chandran , Novel Algorithm for Converting 2D Image to Stereoscopic Image with Depth Control using Image Fusion, Vol. 2, No. 1, March 2014 J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
2. J. Konrad, M. Wang, and P. Ishwar, 2D-to-3D image conversion by learning depth from examples, , in Proc. IEEE Comput. Soc. CVPRW, Jun. 2012, pp. 16-22. K. Elissa, "Title of paper if known," unpublished.
3. Zeal ganatra, conversion of 2d images to 3d using data mining algorithm, international journal of innovations and advancement in computer science, ijiacs , vol. 22, no. 9, september 2013.
4. Janusz Konrad, Learning-Based, Automatic 2D-to-3D Image and Video Conversion, Fellow, IEEE, Meng Wang, Prakash Ishwar, Senior Member, IEEE, Chen Wu, and Debargha Mukherjee, 2012.
5. Raymond Phan, Richard Rzeszutek, Dimitrios Androutsos, semi-automatic 2d to 3d image conversion using scale-space random walks and a graph cuts based depth prior,18th IEEE International Conference on Image Processing, 2011.
6. Q. Wei,2D to 3D: A Survey, Information and Communication Theory Group (ICT) Faculty of Electrical Engineering, Mathematics and Computer Science Delft University of Technology, the Netherlands, December.
7. M. H. Feldman and L. Lipton, "Interactive 2D to 3D Stereoscopic Image Synthesis", in Proc. of the SPIE, Vol. 5664, pp. 186-197 (2005).
8. Battiato, S.; Capra, A.; Curti, S.; and La Cascia, M, "3D Stereoscopic Image Pairs by Depth-Map Generation", in Proc. of 2nd International Symposium on 3D Data Processing Visualization and Transmission, 3DPVT (2004).
9. W.J Tam, F. Speranza, L.Zhang, R. Renaud, J. Chan, and C. Vazquez, " Depth image based rendering for multiview stereoscopic displays: Role of information at object boundaries ", in Proc. of the SPIE, Vol. 6016, pp. 75-85 (2005).
10. W. J. Tam and L. Zhang, "Non-uniform smoothing of depth maps before image-based rendering", in Proc. of the SPIE, Vol. 5599, pp. 173-183 (2004).
11. Jaeseung Ko, Manbae Kim and Changick Kim, School of Engineering, Information and Communications University Munji-dong, Yuseong-gu, Deajeon, Korea, Proc. of SPIE Vol. 6696 66962A-1.
12. Salvatore Curti, Daniele Sirtori, and Filippo Vella, "3D Effect Generation from Monocular View", in Proc. of the First International Symposium on 3D Data Processing visualization and Transmission, 3DPVT (2002).
13. S. A. Valencia and R. M. Rodriguez-Dagnino, "Synthesizing Stereo 3D Views from Focus Cues in Monoscopic 2D Images", in Proc of the SPIE, Vol. 5006, pp.377-388 (2003).
14. Pedro F. Felzenszwalb and Daniel P. Huttenlocher, "Efficient Graph-Based Image Segmentation", International Journal of Computer Vision, Vol. 59, Number 2, Sept. 2004.
15. O. Chapelle, B. SchÄolkopf and A. Zien. Semi-Supervised Learning. MIT Press, Cambridge, MA, 2006.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication Pvt. Ltd.