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Depth Map Refinement Using Mismatch Handling for Arc Camera Arrangement

Yo-Sung Ho
School of Information and Communications, Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea
Email: hoyo@gist.ac.kr web site: http://vclab.gist.ac.kr

Abstract

Recently, 3D entertainment systems have received a lot of attention mainly due to the financial success of several 3D films. In order to generate 3D image, depth estimation is an essential task. Accurate depth estimation enables users to feel the sense of distance easily and reduce fatigue. The objective of this paper is to generate an accurate depth image sequence using stereo video captured by an arc camera array. In general, stereo-video-based depth estimation using image rectification is carried out with two input videos that are obtained from the parallel camera array [1]. Recently, the arc camera array has been actively used to create immersive 3D videos. In the arc camera array, it is difficult to adopt image rectification methods for correspondence point matching due to serious image distortion [2]. In this work, we estimate depth data without image rectification. The proposed method includes mismatched depth pixel detection and handling based on spatial consistency. In addition, we refine estimated depth pixels based on correlation between the current frame and its neighboring frames in temporal domain.

This paper is implemented as it follows: 1) Initial depth information is measured by an energy function based on Markov Random Field. 2) Mismatched depth pixels are detected by a penalty function, which is modeled by 3D projection. If projected depth pixels are outside the reference image plane or on the same pixel positions in the reference image, we impose penalty on these pixels to become mismatched pixels. 3) The mismatched pixel is assigned by a depth pixel, which is chosen by a weighting function exponentially-modeled by distance and intensity differences between the mismatched pixel and its neighbors. Finally, we pursue improvement of temporal consistency to resolve a high frequency flickering problem. For this task, the smoothness function is used to minimize the difference between spatial consistency and temporal correlation. The procedure of the proposed method is explained in Fig. 1. We observe that the conventional depth estimation method using image rectification generates many depth error pixels. In contrast, the proposed method provides high performance on depth estimation. Furthermore, our method reduces visual discomfort to viewer's eyes. Consequently, the proposed method provides more stable results than the image rectification-based method.

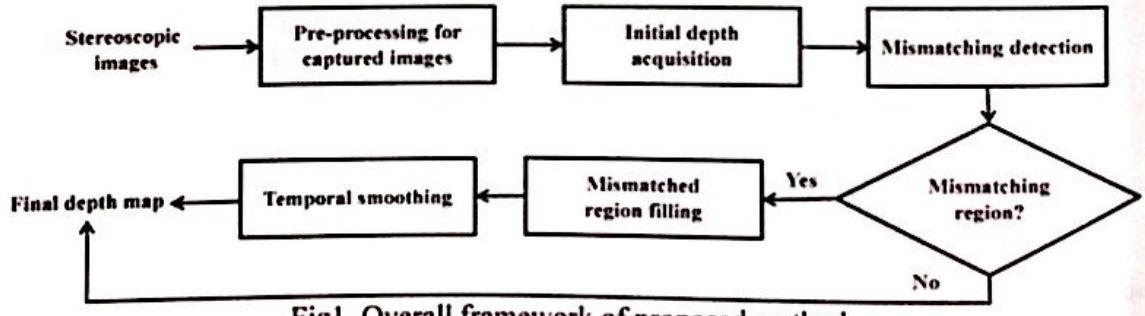

Fig1. Overall framework of proposed method

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References

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