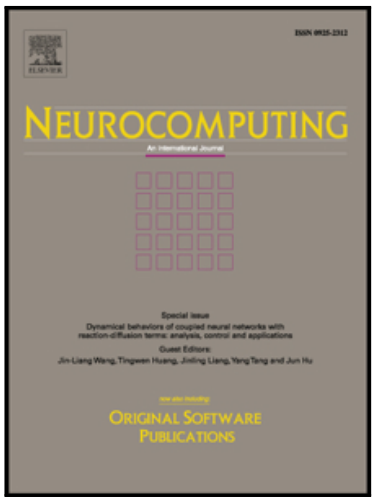

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PII: S0925-2312(17)30653-7
DOI: 10.1016/j.neucom.2016.11.083
Reference: NEUCOM 18316

To appear in: *Neurocomputing*

Received date: 29 October 2015
Revised date: 24 November 2016
Accepted date: 28 November 2016

Please cite this article as: Zhong-jie Zhu , Qinyan Dai , Hybrid Scheme for Accurate Stereo Matching, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2016.11.083

Hybrid Scheme for Accurate Stereo Matching

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Abstract—Stereo matching is a key technique in the field of 3D image and video processing and it plays an important role in a practical stereo vision system. Though stereo matching has been extensively studied and many techniques have been proposed, accurate and efficient stereo matching is still challenging and this issue is worthy of being further studied. In this paper, a novel stereo matching scheme is proposed by jointly exploiting segmentation information, disparity continuity constraints as well as the adaptive support-weight (ASW) technique aiming to acquire efficient and accurate matching results. The proposed scheme consists of two major steps, initial matching and disparity refinement. In the initial matching step, both the reference image and the target image are segmented followed by WTA-based matching, where a new matching cost is developed by jointly exploiting segmentation information, disparity continuity constraints as well as the ASW techniques. Compared with the original one in ASW, ours can reduce the errors in depth discontinuities, repetitive patterns and low texture regions effectively and improve the matching accuracy significantly. In the disparity refinement step, a effective comprehensive refinement scheme is designed by performing measures of occlusion detection, boundary disparity initialization, disparity plane fitting, outlier suppression and discontinuity amendment, which can further correct matching errors and improve the matching accuracy effectively. Experiments are conducted and the results show that the proposed scheme can acquire satisfactory results and outperforms most of the existing methods.

Index Terms—stereo matching; adaptive support weight; hybrid scheme; disparity refinement

1. Introduction

With fast development of computer vision and image processing, stereo vision is increasingly employed in visual navigation, object recognition, industrial control and so on [1-3]. As a key technique, stereo matching plays an important role in a stereo vision system. Its purpose is to find the corresponding relation of each pixel between two stereo images obtained from the same scene in different viewpoints. Since stereo matching has critical impact on the performance of a stereo vision system, fast and accurate stereo matching is desired and expected in many applications [4-6].

Stereo matching involves finding the correspondence of each pixel between two stereo images. Depending on the information employed for matching, stereo matching methods can be classified into two categories: global matching methods and local matching methods [7-8]. Global methods use the global information of stereo images to establish a global energy function and minimize it to acquire disparities. They generally can acquire accurate matching results but comes with low efficiency and complicated parameters and are difficult to apply into real-time applications. Classic global matching methods mainly include graph cut (GC) methods [9-12], dynamic programming (DP) methods[13], belief propagation (BP) methods [14] and so on [15-18]. In recent years, many global matching methods have been proposed. In [19]，Wang et al proposed a GC-based matching scheme by using a hierarchical bilateral disparity structure (HBDS) to improve the efficiency of disparity estimation while simultaneously preserving the accuracy of computed disparity map. In addition, to address the well-known foreground fattening effect, a disparity refinement process is proposed comprising a fattening foreground region detection procedure followed by a disparity recovery