REVIEW ON RADIOMETRIC CONDITION USING CENSUS TRANSFORM

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Abstract

Stereovision means 2D to 3D conversion. Image processing of 3D images yields the 3D image. Basically the 3D image is a depth map. The census transform method used in most of the stereovision applications is for radiometric distortion elimination .The false matching of pixels, error rate are mentioned. The census transform along with various other methods are also studied in different ways. Here in this proposed method studies how the census transform is used.

Index Terms: disparity map, AD, SAD, stereomatching.

I. INTRODUCTION

Stereovision is a vast area in machine vision .The 2D to 3D construction involves various preprocessing and post processing steps. The 3D reconstruction involves various challenging factors like, radiometric distortions, occlusions, texture less regions, illumination conditions.

The stereomatching in image processing is still a problem due to these factors. Conventional sterreomatchinng algorithms used for finding disparity map involves four steps [1], Matching cost computation, cost aggregation, disparity selection and disparity refinement.

Matching cost computation involves how much the two images match. Cost aggregation means, aggregation of all the cost from the matching cost computation. Disparity selection involves, selecting the correct matching pixels, and compute the disparity map. Disparity selection can be done using local and global approaches .Fig 1 shows the basic stereovision steps.

The various exposure and illumination condition, that means various radiometric conditions. For one illumination condition, exposure1, exposure 2 means for one brightness condition, the shutter speed of camera varies. In practical or realtime applications sometimes the brightness condition in left image and right image taken by stereo camera varies

Left image Right image

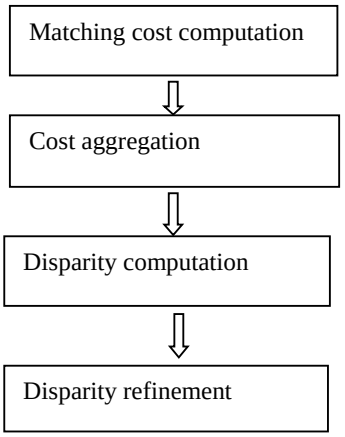

Fig 1: Conventional stereovision algorithm

In most of the cases when the accuracy increases the speed increases, speed of processing decreases, and when speed increases accuracy decreases. Here an accurate method, involving census transform is compared. The performance improvement in the depth map calculation using census transform having various radiometric distortions are discussed.

Most of the stereomatching algorithm uses SAD Sum of absolute difference for matching cost computation which is time consuming. The performance evaluation of different stereovision

algorithms considering various radiometric condition pave way for the future trends in stereovision.

The left image and the right image are taken from the stereo camera. Datasets are available from htt://vision.middleburry.edu/stereo/. Accessed May 2013.
The local and global methods are the two classes [7] used for dense stereo computation [2]. Yufu Qu, Jixiang Jiang has conducted a study on local stereomatching under varying radiometric condition and observed that the performance of the algorithm is insensitive to changes in radiometric conditions. Their result proved that, their proposed algorithm achieved high accuracy, dense disparity estimation and is more robust to radiometric differences [1].
The fast census transform using SSE2 instructions Young KiBaik, Jung Ho Jo et.al [3] showed real time census transform can be implemented on PC –based system with variable window sizes and disparity ranges. Siddhartha Gautama, Simon Lacroix et.al [4] performed a modified census transform and compared with ZNCC and CT. Census transform is better in accuracy and speed as compared to Zero mean normalized cross correlation. For the human safety it is very much important to control the airfring in the ears. If the position of the person is known, the passenger safety can be achieved. Using modified Census transform the time of processing is reduced and very much suitable for real time applications [5]. In 2016 Rostam Affendi Hamzah and Haidi Ibrahim presented a literature survey on stereovision disparity map algorithms. It provides the summary of all the existing stereomatching disparity map algorithms. Both software based and hardware based algorithms are discussed. The four main stages of disparity map calculation [1] by Scharstein and Szeliski is explained in this literature survey. The various existing algorithms and its drawbacks and futurescope are studied.

II. CENSUS TRANSFORM IN STEREOVISION

Stereo matching is a sub problem in stereovision, which provides the matching of pixels from left image and the right image, so that we can get the correct 3D point in space. Different disparity algorithms exists using census transform. The main advantage of census transform is, it works for quality matching at object boundaries [6] M Humenberger, C.Zinner et. al.

$$S(x,y) = \text{Bitstring}_{(I,j)\varepsilon W}(I(I,j) \geq I(x,y)) \quad (1)$$

S(x,y)- census,
(I,j) is an element of the window
I(x,y)-neighbouring pixel within the window

The center pixel and the neighbouring pixel within the window is converted into a bit string.

$$A(x,yd.) = \sum \text{Ham}(s(x,y)) - S(x-d,y) \quad (2)$$

A(x, y,d) -census transform
S(x,y) -census of left image
S(x-d,y) -census of right image
d- disparity,horizontal displacement
Ham – Hamming distance between the two strings of equal length is the number of positions at which the corresponding symbols are different.
Equation (2) represent the census transform which is equal to the difference in bitstring of left and right image, hammed over the window . Census transform is a local transform method.

III. STEREO MATCHING UNDER VARYING RADIOMETRIC CONDITION USING CENSUS TRANSFORM.

Robust stereomatching method using census transform is a current research area, where it deals with various illumination and exposure conditions. Most of the papers used Middlebury dataset as the left and right images for various radiometric conditions. The true disparity map is also available in the Middleburry benchmark. In 2015, Christos Stentoumis, Aggelos Anditis defined (modified census transform) for better results in case of local radiometric differences such as different illumination conditions. The modified census transformation is defined on image gradients and evaluated under radiometric differences stereomatching. Compared to classical census transformation, modified census transform is more efficient, robust against monotonic changes in intensities.

Many of the stereomatching algorithms that assuming corresponding pixels in a stereo pair having same intensity values exist. In 2015 Phuc

Nguyen Hong et.al developed a novel local stereomatching method which operates with stereo images captured with different illumination and exposure between two cameras. The Kemeny and Snell's distance is used to compute matching cost values and use segmentation based plane fitting to locally smooth the matching cost values. They compared, their method with belief propagation, census transform-based and adaptive normalized cross correlation stereomatching methods. Compared to ANCC, BP, KSP Census has 21.711 as average error percentage [9]. Illumination and color invariance are important problems in computervision (CV). The census transform can resist change of illumination and intensity and is widely used for many applications in CV and consumer electronics. Only grayscale images are processed in CT algorithm. Here, color census transform based on color invariance model for stereomatching is proposed because color images are with more significant features and most source images are color. The modified CT significantly improve structure features of disparity maps, compared to the grayscale MCT. Color Census transform doesn't get affected by shadows , highlights and variations in illumination[10].

IV. CONCLUSION

In many of the radiometric applications census transform is used. Census transform works under various illumination conditions. Census transform is excellent against monotonic changes in intensities. Conventional census transform uses color images. Census transform perform well in stereovision applications.

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