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***Abstract*— This paper proposes modification of the conventional Sum of Absolute Differences (SAD) for performance improvement in depth-map estimation from stereo images captured by a camera in a stereo system. The conventional SAD is commonly search in whole stereo images to find out the difference in pixels between the left and right captured images, and then obtains the corresponding disparity map and this may lead to high elapsing time. In order to reduce the number of searching pixels, the proposed modified SAD tries to estimate the difference only from edge pixels which are referred as pixels-of-interest and bring significant information about depth map. The number of pixels being searched is reduced to about 17% on the total pixels, hence the total elapsing time is saved up to around 89% compared to that of the conventional SAD. This results is promising for implementation of a real-time vision system.**

***Keywords*— sum of absolute difference, stereo camera, disparity map, stereo vision**

I. Introduction

Stereo matching is a problem to find correspondences between two input images [1], [2]. It is one of fundamental computer vision problems with a wide range of applications, and hence it has been extensively studied in the computer vision field for many recent years . Stereo matching consists to find for each point in the left image, its corresponding in the right one. The difference between horizontal distances of these points is the disparity. A disparity map consists of all the possible disparity values in an image. Such a map is basically a representation of the depth of the perceived scene. Therefore, the disparity maps have been used to address efficiently problems such as 3D reconstruction, positioning, mobile robot navigation, obstacle avoidance and many other domains [3], [4].

There are three broad classes of techniques, which have been used for stereo matching: area-based [5], [6] feature-based [7], and phase-based [8]. SAD-based implementations are the most favorable area-based techniques in real-time stereo vision, since they can be straightforwardly implemented in hardware. The calculations required in terms of design units are simple, since only summations and absolute values are performed. Parallel design units can be utilized in order to handle various disparity ranges, in order to reduce the computational time required. [9] SAD correlation algorithm can be applied to solve the problem automatically detect mold applications in robot control and mapping. The research results show that the SAD correlation algorithm can be a potential replacement for SIFT method proposed by Lowe [10] in the landmark selection problem. The purpose of the SIFT method [11] is quoted as a full-featured constant rate, rotate, move but criticized the selection of stable characteristics proved more effective when reproducing 3D or service of navigation.

Typically, the disparity is computed as a shift to the left of an image feature when it is viewed in the right image, it is calculated by determining a measure of the SAD, that is used to calculate disparities at each pixel in the right image [12]. After this SAD "match strength" has been computed for all valid disparities, the disparity that yields the lowest SAD is determined to be the disparity at that location in the right image. Hence, the computation of a disparity map is performed on all pixels of stereo images so this approach may be influenced by an object's position and large elapsing time to determine the corresponding points between the two images, especially for huge size of captured images or frames.

In this paper, the proposed SAD algorithm tries to modify the way of disparity determination by utilization of edge information extracted from the captured stereo images. Since edges operators used in the proposed method require fewer computational load, the disparity map can be represented with low elapsing time while maintaining reasonable quality of the map reconfiguration.

The rest of this paper is organized as follows: Section 2 describes modifications in the proposed SAD method to determine a disparity map. In Section 3, experimental results obtained on real images are presented and discussed. Finally, Section 4 concludes the paper with some remarks and future works.

II. Implementation of SAD

A. *Basic implementation of SAD*

1) *Stereo vision system*

The epipolar geometry of the stereoscopic system is described in Fig. 1[13]. The stereoscopic system model shows two different perspective views of a point in the obstacle (P) from two identical camera centres, which are separated only in X axis by a baseline distance. The points P_L and P_R in the image plane are the perspective projections of P in the left and right view. The plane passing through the camera centres and