Robust Block-Based Motion Estimation for Image Reconstruction Using Bi-direction Confidential

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Abstract- In block-based motion estimation where the outcome of the motion vector (MV) is used to reconstruct the image, noise is one of the major problems that impact the quality of the performance in image reconstruction. There are several aspects to improve the quality of the reconstructed image but we focus on improvement of the accuracy in MV from existing block-based motion estimation algorithms when they applies our proposed model only without other any additional models. Because we would like to prove that our proposed model improves an accuracy of the MV that it leads to the better quality of the reconstructed image as a result. This paper presents robust block-based motion estimation where bi-direction confidential model is applied over the existing block-based motion estimation algorithm to improve the accuracy of the MV itself. In the experiment where we simulated several Additive White Gaussian Noise (AWGN) levels over several experiment sequences, we found that the proposed model improved the quality of the reconstructed image when it is applied over several existing block-based motion estimation algorithms. In our experiment, we evaluated the quality of reconstructed image by using Peak Signal to Noise Ratio (PSNR).

I. INTRODUCTION

Motion estimation is an important technique in video compression area which impacts various video encoding standards such as MPEG-1, MPEG-2, MPEG-4, H.261, H.263, and H.264 [1]-[3]. It reduces data redundancy to render image in video sequences and allowed a better compression of video which the smaller size and faster transmission is the consequence outcome. In general predictive, the difference between the current frame and the predicted frame based on previous frame, the MV is identified and transmitted. The algorithms about the block-matching are widely used to present due to their simplicity on hardware implementation. Most of block-based motion estimations algorithms were proposed to improve the accuracy of MV, fasten the speed of computation, or reduce complexity. Here, we focus on four well know block-based motion estimation algorithms such as full search (FS), Block-Based Gradient Descent Search (BBG) [4], New Diamond Search (DS) [5], and Hexagon Search (HS) [6]. We focus on these 4 algorithms because FS is tradition standard where BBG, DS, and HS are the later proposed algorithms that improved the performance in different aspect over accuracy in MV, speed, and complexity as referenced from the performance evaluation of D. Kesrarat, and V. Patanavijit [7-8]. In this paper, we propose the robust block-based motion estimation for image reconstruction using bi-direction confidential organized as follow. Section II explains considered block-based motion estimation algorithm. Section III proposes our robust model. Section IV explains the condition in the experiment with the results and conclusion.

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II. BLOCK-BASED MOTION ESTIMATION

A. Full Search (FS)

FS is the simplest algorithms for block-based motion estimation. In FS, opening block size and searching window are defined. In Fig.1 show opening block size 8×8 with search window area 16×16 and number of searching point (SP). Then, the block matching is proceeded over every searching point for the minimum distortion (MD) to be considered as the block MV.

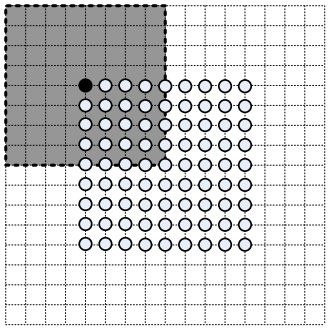

Fig. 1 Full Search Algorithm

B. Block-Based Gradient Descent Search (BBG) [4]

BBG was proposed in 1996 by L.K. Lui, and E. Feig. described as:

Stage1: Center of SP (*cx,cy*) is located with step size equal to 1. Eight SP at length of step size around the center as in Fig2(a) are selected for comparison (*cx+1,cy cx,cy+1 cx+1,cy+1 cx-1,cy cx,cy-1 cx-1,cy-1 cx+1,cy-1 cx-1,cy+1*). If the MD is at center, it is considered as the MV, else proceed stage2.

Stage 2: The center is relocated to the MD point from previous stage as in Fig2(b). Then, eight SP at distance of step size from the center as same as stage1 are selected for comparison but skip the SPs that were compared in previous stage. If the MD point in earlier stage belongs in "X" shape as in Fig2(b), five more SPs are selected for comparison. However, if the MD point in previous stage belongs in "+" shape as in Fig2(c), three more SPs are selected for comparison. If the MD is at center, it is considered as the MV, else repeat stage 2.