MOTION VECTOR RECOVERY FOR ERROR CONCEALMENT BASED ON ANGULAR SIMILARITY

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ABSTRACT

This paper presents a motion vector (MV) recovery using the similarity of the angle of the corresponding surrounded MVs. The approach is based on the assumption that a group of macroblocks (MBs) which belongs to the same object and resides in the same region likely to move in the same direction. Hence, those corresponded MVs that move in the same direction likely to have similar angle. As a result a lost motion vector can be estimated using a set of candidate MVs selected from the neighbouring MVs on the left, top-left, top, top-right, right, bottom-right, bottom and bottom-left. The experimental results for several test video sequences are compared with conventional error concealment methods and higher performance is achieved in both objective peak signal-to-noise ratio (PSNR) measurements and subjective visual quality.

Index Terms— Motion vector recovery, temporal error concealment, image restoration, image enhancement

1. INTRODUCTION

There are many conventional temporal error concealment algorithms. One of the most commonly used techniques is temporal replacement (TR) which simply replaces a lost macroblock (MB) with the corresponding MB from the previously encoded frame, i.e. zero motion vector replacement [1]. The technique is very effective in stationary region but significantly degraded in dynamic area. Another commonly used technique is the average motion vector (AVMV) which replaces a corrupted MV using the average value of selected surrounding MVs [2].

More advanced schemes which choose the candidate MV that returns the smoothest MB boundary matching such as block matching algorithm [3]–[5] or boundary matching algorithm (BMA) [6] are widely implemented. The BMA was chosen to implement in the H.264 reference software as the temporal error concealment method. Several temporal error concealment techniques had been developed and proposed in order to enhance the performance of the BMA.

MV_{TL}	MV_T	MV_{TR}
MV_L	MV_C	MV_R
MV_{BL}	MV_B	MV_{BR}

Fig. 1 corresponded MVs

The selective motion vector matching (SMVM) algorithm enhanced the performance of the original BMA by addressing edge-block problem and also including the adjacent MB on the right in boundary matching criterion [7]. Another algorithm based BMA, called refined boundary matching algorithm (RBMA), was proposed by Chen et al. The technique uses different motion vector for different regions to conceal a lost MB [8].

In this paper, a temporal error concealment algorithm based angular similarity of the surrounding motion vectors is proposed. First, the angles of the surrounding MVs on the left (MV_L), top-left (MV_{TL}), top (MV_T), top-right (MV_{TR}), right (MV_R), bottom-right (MV_{BR}), bottom (MV_B), and bottom-left (MV_{BL}) are calculated. Second, the calculated angles are grouped into a group of sector. Finally, a lost MV is calculated from candidate MVs which reside in a selected group of sector.

The paper is organised as follow. Section 2 describes the proposed algorithm. Simulation results and conclusion are given in Section 3 and 4 respectively.

2. PROPOSED TECHNIQUE

The proposed technique consists of sectorisation of the calculated angles and estimation of a lost MV.

2.1. Sectorisation of the Calculated Angles

The angles of the neighbouring MVs, θ_s, on the left, top-left, top, top-right, right, bottom-right, bottom, and bottom-left are calculated using: