Motion Vector Prediction in Multiview Video Coding

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Abstract*—In video coding, motion vectors always account for a large number of bits and affect coding efficiency largely. In this paper, we propose an efficient motion vector prediction algorithm for multiview video coding (MVC), which can predict motion vectors from adjacent views and achieve good prediction accuracy. We first investigate the correlations among different views and describe the disparity between adjacent views as global motion. The affine model is used to compute the global parameters between frames of adjacent views. At least one view is coded independently without interview prediction. After that, motion vectors of the frame to be coded can be derived from the motion vectors of the co-located coded frame in adjacent view using the global motion information. A rate-distortion optimization scheme is used to choose between the proposed method and traditional motion compensated prediction method. Experimental results show that, compared to simulcast coding, the proposed algorithm can achieve good performance and improve the coding efficiency up to 0.8 dB in PSNR.

Keywords-multiview; MV; prediction; GMC

I. INTRODUCTION

Multiview video consists of video sequences captured by multiple cameras at the same scene and time but different positions. The key characteristic of multiview video is interaction and it can be used for a wide variety of applications including free-viewpoint television (FTV), 3D television (3DTV), immersive teleconference and surveillance [1]. Because of the large data amount, multivew video needs much more storage space and bandwidth than traditional video. Therefore, how to compress multiview video efficiently has become popular due to its wide application.

In the past years, some work has been done on multiview video coding based on improving overall compression efficiency. Due to the high correlation between adjacent views, interview prediction has become the main goal of the researchers. In [2], a multiview matching cost as well as pure geometrical constraints algorithm is used to estimate disparity and to identify the occluded areas in the views. In [3], a sprite generation algorithm in multiview sequence is proposed to improve coding efficiency. Recently, MPEG/3DAV ad-hoc group has started the work on 3DAV standardization. Some MVC scheme and experimental results have been reported [4]-[5]. All these work tries to utilize the interview correlations to improve the overall coding performance.

However, none of above methods investigates the high correlation and similarity between motion vectors of adjacent views. We found that, because of the special characteristic of multiview video, the disparity between adjacent views can be described with global motion model. That is, the movement of the static background between adjacent views can be predicted with global motion compensation (GMC). Therefore, the motion vectors of frames to be coded can be predicted from the co-located frames of adjacent views utilizing the global information and large amount of bits for motion vectors can be saved.

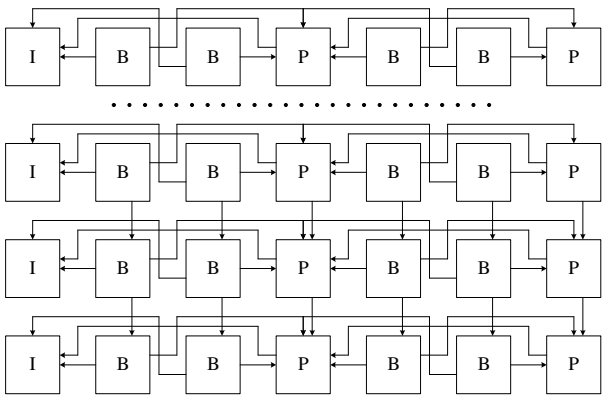
In this paper, we propose a novel motion vector prediction (MVP) algorithm for MVC based on global motion vector (GMV). In our algorithm, affine motion model [6] is used to compute the global motion parameters between adjacent views firstly. Then, GMVs for macroblocks of the current frame to be coded are computed and used to derive their temporal motion vectors. After that, a rate-distortion optimization (RDO) scheme is used to evaluate the accuracy of the MVP and select the proper mode between MVP and temporal MV. The proposed algorithm has been used in the MVC scheme we proposed in [7] and achieves good coding efficiency. In addition, it can be used in MVC based on other schemes, i.e. wavelet based lifting scheme.

The remainder of this paper is organized as follows. Section 2 describes the MVC structure and the basic idea of motion vector prediction. Section 3 presents the computation of predictive motion vector and the Rate-distortion optimization strategy in details. In section 4, experimental results are given. Finally, conclusions are drawn in section 5.

II. MVC STRUCTURE BASED ON MOTION VECTOR PREDICTION

A. MVC Structure

The following diagram gives the MVC coding structure which is adopted by the proposed MVP algorithm.



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