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Open Multiprocessing Aided Overlapped Motion Compensated Temporal Interpolation

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Abstract— Many today's multimedia applications demand low bit rate transmission of the video sequences due to the limited bandwidth of transmission channels. Video compression is particularly required for these applications for the reception of an acceptable video quality at receiver. An important part of many video compression techniques is motion compensation. Overlapped Motion Compensated Temporal Interpolation (OMCTI) is a block based search approach for the temporal interpolation of skipped frames. It generates interpolated frames with considerably improved video quality at the receiver. Motion compensation is computationally complex and data intensive operation. The multi-core processor has captured major portion of the market due to its enhanced computational capabilities. Increase in single-core microprocessors' performance is limited by semiconductor scaling, associated power and thermal challenges. Currently multi-core CPUs have turned out to be the mechanism for the enhancement of the processor's performance to overcome these limitations. Parallel processing is a very cost-effective solution for the computationally large and data intensive problems. Parallel processing changes the whole way we live. In this work, we speed up the motion compensation by leveraging the multicore processors and an Open MP based multithreaded approach is established to reduce the computational complexity of the OMCTI. The performance of the proposed multi-core processor technique is evaluated with reference to the bench marker as single-core processor in order to analyze the performance tradeoffs. The paper is concluded with a discussion about the generated experimental results. Multi-core processors achieve performance enhancement of 30% - 50% in different scenario while the single-core processors, the bench marker, performance is improved by 5% at the most.

*Index Terms—*Block based search, Motion Compensated Temporal Interpolation (MCTI), Multithreading, Open MP, Overlapped Motion Compensated Temporal Interpolation (OMCTI)

I. INTRODUCTION

The advancement in multimedia application has caused increase in the video display formats and video processing techniques. This increase has resulted in the demand for efficient conversion of one video format to other video formats. Even with the current advancements in the communication infrastructure, bandwidth is still a valuable commodity and many modern multimedia applications still require low bit rates for the video transmission. Video

compression is one of the very important processes required for the effective utilization of the channel bandwidth. Every digitized video is comprised of considerable amount of redundant data and compression can be accomplished by exploring these redundancies of videos. These redundancies are generally classified into subjective redundancy and statistical redundancy. The goal of video compression techniques is to reduce the amount of both temporal and spatial redundancies in videos. Motion compensation is very popular technique for video compression. It can take advantage of high temporal correlation between the successive frames. Temporal subsampling is very simple approach for achieving low bit rate requirement. Other compression techniques can be combined with the temporal subsampling to achieve better compression rate. In this approach, the frame rate is reduce at sender side by skipping the frames after a specific interval like transmitting one frame and skipping the next frame and repeats this pattern for the complete video. The dropped frames are required to be reconstructed at the decoder side with the intention of achieving the original frame rate at the receiver end. A simple frame reconstruction method like frame repetition can be used but the output videos are not of good quality and may results in jerkiness. Chi-kong Wong et al in [1] has proposed a technique called Motion Compensated Temporal Interpolation (MCTI) for reconstruction of skipped frames. MCTI is a block based motion compensation algorithm. In MCTI, motion vector for each block is computed by following the blocks between consecutive frames. The displacement between the matched blocks of successive frames is used to place the blocks at appropriate locations in the reconstructed frame and then reconstructed frame is added in between the successive frames to increase the frame rate. MCTI is a block based algorithm so the inserted frames tend to be blocky. Similarly Chi-Kang Wong et al in [2] proposed a technique called Overlapped Motion Compensated Temporal Interpolation (OMCTI) technique to reduce this blocky effect in the reconstructed frame. Main drawback of MCTI and OMCTI algorithms is its massive computational requirements. In order to increase the processors speed, currently the processors manufacturers use to add more processors instead of increasing clock frequency to increase the processor speed. Hence the applications must have to be