Low-complexity Video Compression Based on 3-D DWT and Fast Entropy Coding

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Abstract

One of the top tasks for video streaming, video surveillance, video conferencing and video broadcasting is a low-complexity and real-time video coding and transmission over wireless channels. Taking into account high bit error ratios, packet losses and time-varying bandwidth of wireless systems, the scalable video coding (SVC) is more preferable as compression method for wireless video transmission.

The most popular scalable video coding approach is based on extension of the H.264/SVC standard [1]. This extension includes temporal, spatial and quality scalability and provide high compression efficiency due to motion estimation and compensation exploiting the video source temporal redundancy and inter-layer prediction exploiting redundancy between different layers. But these methods require high computational complexity. Therefore, using of H.264/SVC codecs is difficult for real-time video compression and transmission.

As an alternative, approaches based on three-dimensional discrete cosine transform (3-D DCT) [2] or three-dimensional discrete wavelet transform (3-D DWT) [3] can be used. This approaches do not use motion estimation for exploiting of the video source temporal redundancy. Therefore, it has lower computational complexity.

This presentation describes a video compression algorithm based on 3-D DWT with simple bitplane entropy coding. Proposed entropy coder uses Levenshtein codes for zero-run-length compression. Therefore, computation complexity of this coder is significantly less than bit-plane arithmetic coder in JPEG2000 standard [4] and entropy encoder in 3-D SPIHT algorithm [3].

In addition video source rate control based on adaptive Lagrange multiplier selection is introduced [5]. Practical results which show the compression efficiency of the proposed algorithm in comparison with H.264/SVC standard, 3-D DCT and 3-D SPIHT are presented.

Index Terms: Low-complexity video coding, 3-D DWT.

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