Title
Advanced motion information coding and deblocking techniques for scalable video compression

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Abstract
Today, the increasing heterogeneity of play-back devices and networks poses substantial problems for multimedia content distribution applications, since different end-users require a separate version of the content, specifically tailored to their terminal and connection characteristics. Scalable video coding schemes, which produce a single compressed bit-stream from which content representations with a different quality, resolution, and frame-rate can be extracted without the need for re-encoding, are considered to be the best solution to tackle this problem.
Wavelet-based video coding technology can provide full support for scalability while delivering state-of-the-art compression performance. In this dissertation, several problems limiting the compression efficiency and functionality of wavelet-based scalable video coding schemes are tackled.
A major part of our work is related to motion information coding in wavelet-based scalable video codecs. The majority of these video codecs employ motion compensated prediction or motion compensated temporal filtering to eliminate the temporal redundancies from the video material. This means essentially that a motion model is used to estimate the object and camera motion between subsequent frames and that the estimated motion is used as a basis for the efficient prediction of frames based on their neighboring frames. To allow proper reconstruction of the video sequence at the decoder side, the parameters of the motion model describing this estimated motion need to be encoded using a motion information codec and sent to the decoder.
The first part of our work is focused on wavelet-based video coding approaches employing so-called in-band motion compensated prediction or in-band motion compensated temporal filtering (MCTF). These approaches produce significantly more motion information than their spatial-domain equivalents, which affects the compression performance, particularly when targeting low bit-rates. To resolve this problem, efficient motion information coding schemes for in-band motion estimation are proposed in this dissertation.
As a second contribution, this thesis presents a novel quality scalable motion information coding scheme for video codecs employing spatial-domain MCTF. Quality scalable motion information codecs produce a single scalable bit-stream which can be truncated at specified locations to produce a lower-quality, lower bit-rate representation of the motion
information. Using quality scalable motion information coding leads to a systematically better compression performance when targeting low bit-rates and can indirectly lead to improved compression performance at higher bit-rates as well, since the complexity and corresponding accuracy of the motion field are no longer limited by the lowest bit-rate that needs to be supported. The quality scalable motion information coding technique proposed in our work outperforms state-of-the-art wavelet-based solutions. To be able to practically benefit from the proposed scheme, two rate allocation strategies for wavelet-based video codecs, capable of optimally distributing the available bit-budget between texture and motion information are also proposed.

A final contribution of this work is a novel adaptive deblocking filter which resolves the problems caused by block-boundary discontinuities in wavelet-based video codecs employing a block-based motion model. Applying the proposed deblocking filter yields the same visual quality as using classical overlapped-block motion compensation but requires significantly less processing time when targeting a PC platform implementation.