



Rate-Distortion Based Video Compression: Optimal Video Frame Compression and Object Boundary Encoding

Guido M. Schuster, Aggelos Katsaggelos

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One of the most intriguing problems in video processing is the removal of the redundancy or the compression of a video signal. There are a large number of applications which depend on video compression. Data compression represents the enabling technology behind the multimedia and digital television revolution. In motion compensated lossy video compression the original video sequence is first split into three new sources of information, segmentation, motion and residual error. These three information sources are then quantized, leading to a reduced rate for their representation but also to a distorted reconstructed video sequence. After the decomposition of the original source into segmentation, motion and residual error information is decided, the key remaining problem is the allocation of the available bits into these three sources of information. In this monograph a theory is developed which provides a solution to this fundamental bit allocation problem. It can be applied to all quad-tree-based motion compensated video coders which use a first order differential pulse code modulation (DPCM) scheme for the encoding of the displacement vector field (DVF) and a block-based transform scheme for the encoding of the displaced frame difference (DFD). An optimal motion estimator which results in the smallest DFD energy for a given bit rate for the encoding of the DVF is also a result of this theory. Such a motion estimator is used to formulate a motion compensated interpolation scheme which incorporates a global smoothness constraint for the DVF.

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