Fast Motion Compensated Framerate Upsampling

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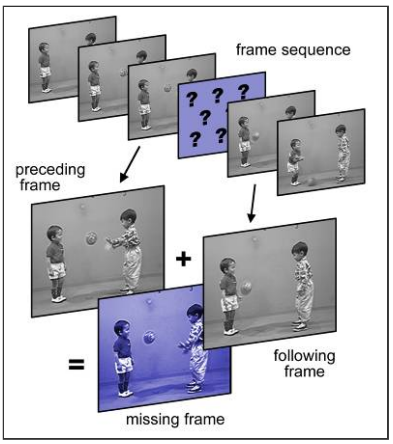
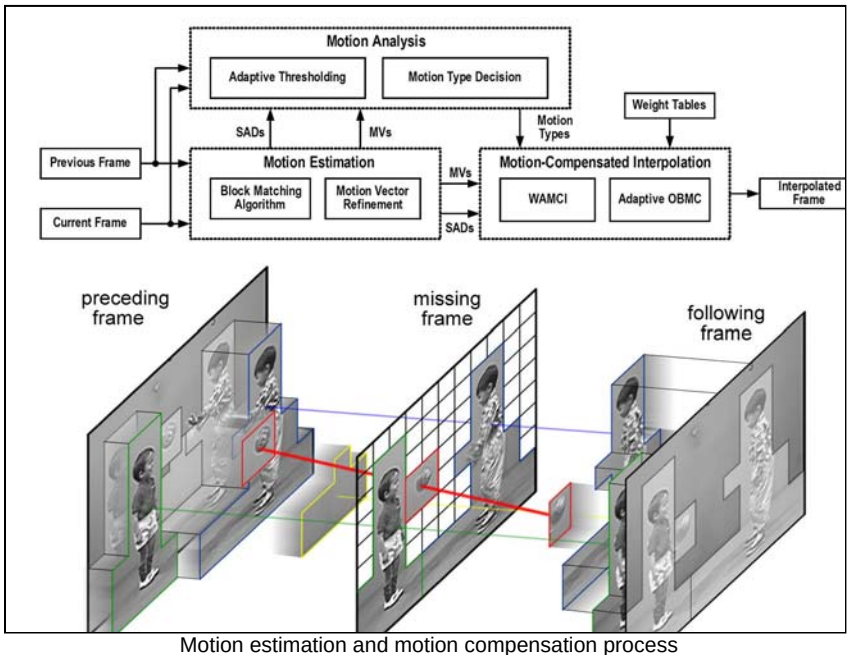


Video sequence and missing frame

Problem: From a technical point of view, a digital video simply represents a sequence of still images displayed at a specific framerate (frames per second). In transmission applications, such as video streaming to mobile devices, certain frames may get lost by the channel and/or become unusable for the decoder. In order to regain good video quality the missing frames have to be estimated and reconstructed in the decoder stage. This technique can also be used in low bandwidth applications where a number of frames are skipped in the encoder to cut down data volume for transmission. The process of inserting missing or additional frames is referred to as framerate upsampling. In the reconstruction procedure, the only information available about a missing frame is its preceding and following frame.

Goal: More precise reconstruction of missing frames can be accomplished by first estimating the motion activity within a video sequence. This information can then be used to perform motion compensation. A fast and accurate algorithm for motion information acquisition is needed. Furthermore, appropriate motion compensation that would not introduce annoying visual artifacts is a vital issue of frame reconstruction. The quality and visual appearance of the estimated frame is limited by degrading phenomena present in the video sequence. Some of which are a) changing light conditions, b) occlusion of objects or c) objects changing their shape (e.g. speaking mouth).

Solution: A fast adaptive motion estimation algorithm is used to analyze the motion activity. For a quick and accurate analysis, the algorithm considers spatial as well as temporal correlation. Subsequently, a linear motion model is assumed to perform motion compensation. To reduce disturbing block- and other artifacts, the overlapped blocks are blended by applying an adaptive bilinear weighting function.



Motion estimation and motion compensation process