Real-time preprocessing and video object segmentation for high compression and content-based MPEG-4 coding

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Abstract

MPEG-4 video has been designed as a standard for video and audio compression, content-based functionalities, scalability of texture, images and video, shape coding, robustness in error-prone environment, and face and body animation. With all these functionalities, however, MPEG-4 still has limitations in practical software development.

In this paper, we developed the frame preprocessing for real-time camera image input and motion detection for increasing the compression rate. We also developed the video object segmentation for shape coding. We implemented the motion detection algorithm using parameters. The parameters indicate the difference between the successive frames. If the difference is below the predetermined level, the system does not encode but skip the frame.

We developed the video object segmentation using temporal and spatial information. We have used temporal frame difference between frames to extract the difference information. And we have used the Canny edge detection to obtain the edges of the frame. We applied morphological operation to the discovered edges in the current frame and in the difference frame to render the edges more robustly. The system merges the temporal and spatial information to extract the VOP. The algorithm demonstrates a fast, robust and effective video object segmentation.

We have performed the experiments using real-time camera image input. We have used two types of image sequences, one with high spatial activity and the other with low spatial activity. The images with high spatial activity showed up to 70:1 compression rate with the rectangular frame coding and 180:1 compression rate with the binary shape coding using the developed algorithm. The video object segmentation showed the video object boundary clearly and extracted VOP efficiently.

This paper demonstrated the frame preprocessing and video object segmentation for real-time and high compression MPEG-4. We have developed the real-time camera image input and motion detection algorithm for practical MPEG-4 coding and we have developed the video object segmentation to extract VOP for binary shape coding.

This newly developed MPEG-4 encoding system can be used in a variety of applications such as internet digital contents communication, internet TV, video communication, video conferencing, etc.