



Reducing Perceptual Discontinuity P2P Live Video Streaming Using Adaptive Scheme Based on Frame Loss Visibility

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Abstract: When a live streaming video is delivered over a peer-to-peer (P2P) network, the video is divided into several chunks and distributed to peers. Each chunk has its own playback time deadline. A chunk delay can be a problem of great concern because a serious chunk delay can produce obvious discontinuity of the streaming video, resulting in low satisfaction for a viewer. The playback time of a delayed chunk is overlapped with that of the next chunk. Traditionally, fast forwarding and uniform frame skipping are the two methods used to deal with the chunk delay problem. However, they may easily produce the effect of perceptual discontinuity and perceived by the viewer. This study proposes a frame dropping method based on frame loss visibility information in order to maintain visual continuity of the video. The frame with lower loss visibility will be dropped first. In a previous work, the idea of loss visibility was applied by a router to develop a frame dropping strategy when network congestion occurs. In this work, we apply it to the chunk-level playback controller in P2P network. The number of frames to be dropped is dependent on the value of chunk delay. Given a fixed chunk delay, the main difference between the proposed approach and the uniform frame skipping method is the way of choosing frames for dropping (fast forwarding method does not drop any frame but play all the frames at a faster speed). A viewer's satisfaction is evaluated by using the way of subjective video quality assessment. The proposed method can produce higher MOS (mean opinion score) than that of the traditional methods (fast forwarding and uniform frame skipping), demonstrating the effectiveness of the proposed approach.

Keywords: Video streaming, P2P networks, perceptual discontinuity, frame loss visibility.

1. Introduction

Delivering multimedia data over a peer-to-peer (P2P) network receives more and more demand. P2P downloads data files in a parallel manner from other peers rather than from a single data transfer node in the client server topology. The file transferred by a P2P system is divided into several chunks. The system distributes the chunks to the peers who are interested in the chunks. The peers are coordinated to achieve the goal of file exchange. In the P2P system, a seeder is known as a peer that already has the complete file and it can give the chunks of file to other peers. In contrast, a peer that still needs some chunks from other peers is called a leecher. Video chunk is not just used for local consumption (with playback time deadline), but also for uploading to other peers.

The network impairment to video playback in P2P streaming is rarely packet loss, but only delayed chunk. In this study, we propose a method based on data loss visibility to reduce the bad perceptual effect associated with the chunk delay problem. We propose a video playback design to improve the viewer's satisfaction in visual quality whenever the delay chunk problem occurs. We evaluate the video quality resulted from each method by conducting a subjective experiment. This research proposes a frame dropping method based on frame loss visibility information in order to maintain visual continuity of the video. In addition, this research also proposes an adaptive frame dropping system that performs the task at different locations in chunk file. The performance of this

