ABSTRACT

Due to the time-varying nature of radio link and unpredictable traffic load in the internet, the video streaming employing internet protocol is challenging. Adaptive video streaming could be the solution to deliver content with improved Quality of Experience (QoE) by adapting video parameters over time to time based on the prevailing link conditions. Because of high resolution and frame rate, along with low available bandwidth, the video stream exceeds the available network capacity which degrades the visual quality.

In the first part of the thesis, a mechanism called “Scalable Video Coding for Region of interest (SVCR)” is proposed, in which Region of Interest (ROI) is implemented through cropping of live video. Further, SVCR provides video services with reduced fidelity on enabling the decoding and transmission of partial bit streams to provide enhancement in QoE.

The efficiency of streaming reduces to a larger extent, when the media content is carried over wireless networks. The system architecture has been proposed, in which the QoE is increased by changing the specific video parameters at runtime i.e. dynamically modifying the streaming parameters based on the client’s link capability. In the second part of thesis, an Adaptive Client Server (ACS) algorithm is proposed based on local maxima and local minima, using which the client monitors its incoming bit-rate of streaming video. The client samples and estimates the pattern of incoming bit-rate and sends the status report to the server in a predefined message format. Upon receiving the message the server decides and modifies the necessary video parameter based on the adaptive algorithm.
The traditional approach of bandwidth estimation is not accurate as there are many factors like congestion that can delay the arrival rate of the packet which may lead to a misconception that the bandwidth was low. Thus the optimal approach to this problem will be to estimate the degradation of video quality based on the buffer fullness. In the third part of thesis, to support streaming of live and stored video the proposed method is based on adaptive playback buffer management on the top of HTTP at the client side. Playback buffer is treated as a direct state variable that reflects the network bandwidth. The buffer fullness estimation predicts the buffer value at a point in the near future based on observations of the buffer over a stipulated period of time. The proposed algorithm uses non-linear exponential non-parametric regression for computing the decision parameter.

All algorithms were developed and implemented using custom made open source framework, and the performance evaluation met the objective of thesis. For example, during the experimentation with live video streaming, the regression based proposed algorithm achieved an improvement of 24.48% in average PSNR and 6.63% in average SSIM index against the buffer underflow probability algorithm.