Abstract:

The escalating demand for video content and streaming services has made it a predominant medium of exchanging information in the modern era. This thesis discusses novel techniques to efficiently predict QoE, optimize the end-user viewing experience, and perform user-centric multimedia streaming. First, we devise alternatives that can estimate subjective quality scores essential to evaluate QoE in multimedia applications. We propose MO-QoE, a framework to predict video QoE using Multi-Feature Fusion (MFF) based Optimized Learning Models (OLMs). The end users in Hypertext Transfer Protocol (HTTP) streaming endure video quality variations with time (bitrate adaptations) and rebuffering events due to channel throughput fluctuations. Hence, it is necessary to evaluate the QoE in video streaming scenario in a continuous time (on a per-frame basis) manner to regulate the quality deterioration. The subsequent work presents the design of two continuous, time-varying QoE predictor models. The first is the M-3R predictor, which consists of a network of Long-Short Term Memory (LSTM) that evaluates the time varying streaming QoE resulting from the effects of rate adaptation and rebuffering under the 3R settings. The second is the DeSVQ model which employs a deep learning technique that integrates Convolutional Neural Network (CNN) and LSTM networks, designed to combine multiple stages of feature processing.

Bitrate adaptation algorithms can be used for meeting the dynamic video streaming requirements. It is essential for such applications to ensure high quality and smooth playback, devoid of buffering and frequent quality transitions. To meet these specific needs, we develop a video streaming framework that can intelligently use an adaptive strategy (IAVS) to customize the content bitrate as per the dynamic environment. Next, we study the performance of adaptive multimedia transmissions over a dedicated Digital Video Broadcasting (DVB) network using user-centric feedbacks via WiFi. Despite the increased network capacity of next-generation wireless networks, seamless streaming of higher resolution 360-degree videos and immersive multimedia content is still a challenge. To address this, finally, a machine learning based adaptive Ultra-High Definition 360-degree immersive video streaming solution, MAIVS is presented. This solution effectively decreases the data rate needed for streaming 360-degree high-resolution videos.