Predicting Quality Of Experience For Online Video Systems Using Machine Learning

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***Abstract*— As the expansion of the online video broadcasting continues in every area of the modern connected world, the need for measuring and predicting the Quality of Experience for content delivery has never been this important. This demo paper has designed and developed a real-time and continuously trained machine learning model in order to predict QoE for online video systems. For this purpose, a platform has been developed where video content is unicasted to a cluster of users simultaneously while objective video metrics are collected into a database. At the end of each video, each user is queried with a subjective survey about their experience. Both quantitative statistics (video metrics) and qualitative information (user surveys) are used continuously as training data to machine learning model. The overall results show that proposed QoE estimation system provides an average Mean Opinion Score (MOS) precision with an error rate ranging from 12% to 15%. This methodology can efficiently answer the problem of predicting user experience for any online video delivery system, while overcoming the problematic interpretation of subjective consumer experience in terms of quantitative metrics.**

Keywords*— *Quality of Experience (QoE), Machine Learning, Online Video Services, Content Delivery, QoE Modelling

I. INTRODUCTION

The aim of this paper is to answer the question of measuring user experience and correlating them to objective video consumption and system capacity parameters. Unlike other research works [1, 2] that use time invariant models to predict QoE, in this work real time QoE feedback of users are used to train a model for an online video platform while considering the relationship between quantitative (video metrics) and qualitative observations (user surveys).

II. QOE ECOSYSTEM METHODOLOGY

The proposed QoE ecosystem consists of five main components; Subjects, Content Delivery Network, Web services, Video Platform Manager and QoE Database. The workflow diagram in Figure 1 shows the interactions of components and their influences on calculating QoE. Firstly, subjects request random content via an http request to web service and video platform provides a movie trailer in an asynchronous manner to the user. Following that request, the streams are unicasted to each client simultaneously via CDN. While the users watch the content, video metrics from MPEG-DASH player including stall duration, number of stalls, initial buffering duration, resolution and total watch duration is logged. At the end of each video consumption, users are queried with their opinions about the QoE of the service including overall experience, resolution and initial buffering.

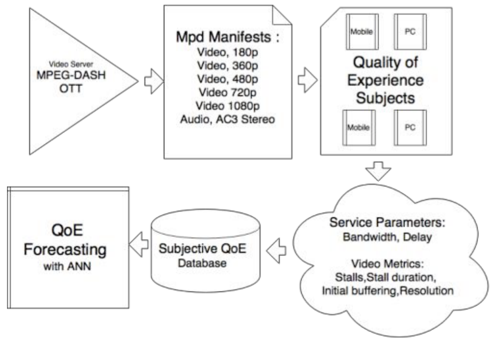

Figure 1. Online Video Platform Workflow

These subjective information and objective video metrics are used to train the model, and future QoE values for a different network-system-user state can be estimated. As the model is continuously trained, overfitting and under fitting states of the model is carefully considered by following a short-term memory strategy where the weights in the model are reflecting the current events while considering the recent past behaviours of the system.

II. CONCLUSION & FUTURE WORKS

As an extension to our research work, wifi, mesh, 4G and 5G network simulators will be used, taking into account cloud computing resource constraints (including edge computing) to cover wide variety of needs of future online video trends.

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