Poster: Using Crowdsourcing Data for Adaptive Video Streaming in Cellular Network

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CCS CONCEPTS

• **Networks** → **Mobile networks**; **Network performance modeling**; *Network measurement*; • **Information systems** → *Multimedia streaming*; • **Computing methodologies** → Machine learning;

1 INTRODUCTION

There have been efforts to improve quality of video streaming for better user experience using Dynamic Adaptive Streaming over HTTP (DASH) [5] streaming. Prior works such as [1, 2] use DASH algorithm to estimate the next suitable streaming quality from the previous video chunks. We based our work on a prior study for adaptive streaming [3], which shows that maintaining the streaming media quality is possible using predictive buffering on 3G network. Our dataset is based on geospatial data collected from the crowd using the `Netradar` [4] mobile network measurement platform.

Our study focuses on providing information for the client on how much it should be buffered. Our approach prioritizes optimized buffering than decreasing the streaming bit-rate quality so that the user experience will not deteriorate. For instance, if we have a crowdsourced throughput measurement that fluctuates from high to low and again to high at a different time; then this could be a good reason to inform the client to buffer ahead of time. By using throughput distribution and historical pattern, we can recommend the client ahead of time (e.g., recommend to buffer enough chunks before the streaming quality starts drooping).

The main **objectives** of this work are: (1) To build a throughput predictor from a crowdsourced measurement data that can be an input to the streaming clients for an optimized buffering decision. (2) To develop a learning algorithm that utilizes the input from the predictor to build a historical pattern which then is used to recommend the streaming quality.

2 EXPERIMENTAL DESIGN

The overall experimental design of our work is depicted in Figure 1. It has four main components. **(1) Streaming client:** is a user that is currently playing the video from the video server and shares its current geographical location to the orchestrator. It adapts the streaming quality and the size of the buffer based on the information and the feedback it receives from the orchestrator. **(2) Video**
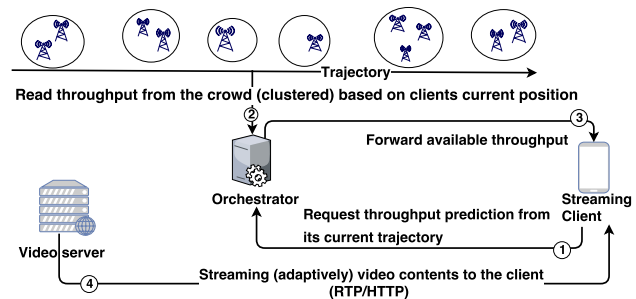
Figure 1: Experimental design

server: stores the video content and is responsible for transferring the video content to the streaming client using a DASH algorithm. **(3) Orchestrator (throughout predictor):** receives clients location from streaming clients and use an algorithm to map users specific location to the appropriate clustered `Netradar` data points. It uses this mapped clustered data points to predict the throughput that the user will experience in the vicinity from the current location. For faster response, it could be deployed and managed within the same administrative boundary. The information gained from the orchestrator is useful to the client to adapt the streaming quality either by buffering ahead of time or reduce the video bit rate. **(4) Clustered dataset:** is the main source of information to the `orchestrator`. The `orchestrator` fetches appropriate clustered data based on the location and timestamp of the streaming client.

Our approach gives priority to the client to fetch from the beginning. Because the client takes one chunk at a time, the `orchestrator` using the crowd dataset will not be fast enough to make a real-time prediction. This approach allows optimized buffering by informing the client about what kind of buffering is good at a given time and location. For instance, if we know that the network condition will possibly get better soon after a bad performance (e.g., from the historical pattern of our data), then the client can buffer only a few chunks which are sufficient enough to cover the performance gap. This can also be used to inform the client about the network quality early enough (e.g., what kind of throughput usually the user would get along a given trajectory). The feedback from the `orchestrator` can be used as a complement to the existing adaptation algorithms and to improve the decision accuracy for quality streaming.

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