

Adaptive Real-time HEVC Encoding of Emergency Scenery Video

A. S. Panayides and A. G. Constantinides
Dept. of Electrical and Electronic Engineering
Imperial College London
a.panagidis@imperial.ac.uk

M. S. Pattichis
Dept. of Electrical and Computer Engineering
University of New Mexico
Albuquerque, USA

E. Kyriacou
Dept. of Computer Science and Engineering
Frederick University
Cyprus

C. S. Pattichis
Dept. of Computer Science
University of Cyprus
Cyprus

Abstract—This paper proposes the use of an adaptive HEVC encoding framework for the wireless transmission of real-time emergency scenery video. The goal of the proposed approach is to adapt HEVC encoding methods and parameters so as to meet time-varying constraints on available bandwidth, video quality, and performance. We present an example in real-time video communications by requiring that the encoding rate can meet or exceed the source video frame-rate at a reasonable delay.

Emergency video, adaptive encoding, encoding, wireless transmission, quality assessment

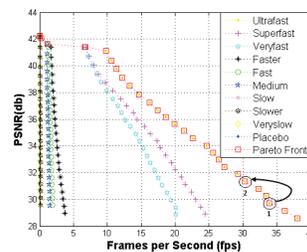
I. INTRODUCTION & METHODOLOGY

Real-time wireless communication of emergency scenery video aims at efficient disaster crisis management. In emergency situations, it can accommodate effective assessment of the disaster incident. Linked with appropriate telemedicine systems (such as AvarisNet [1]), it facilitates on-site coordination of rescue teams, triage, and ambulance dispatch of the most serious injuries to the nearest hospital.

In terms of wireless video communication, the challenge is to provide the appropriate level of video quality that will deliver an accurate reconstruction of the emergency incident to the management site, in real-time [2]. Moreover, given the unpredictable nature of the disaster, the system has to adapt to the available bandwidth given the best available wireless infrastructure. Based on the afore-described opposing constraints, the goal is to maximize video quality without exceeding constraints on available bandwidth, while allowing for real-time encoding (e.g., see [3]).

II. PRELIMINARY RESULTS & DISCUSSION

An emergency scenery video of a simulated earthquake response, as a part of the Cyprus Emergency Response Team training, was used for this series of experiments. The video resolution was 704x576 at 25 frames per second (fps). The video was encoded using the x265 open-source high efficiency video coding (HEVC) software, for 23 different rate points (quantization parameters 20-42), and 10 different encoding speed profiles, for a total of 230 video encoding instances.



(a) Pareto-front for Video Quality vs Encoding Speed

(b) Emergency Scenery Video - 29.7 dB (33.88 fps @ 226 kbps)

Fig. 1. Adaptive HEVC encoding framework example. In this example, we have adaptation for the maximum video quality mode subject to real-time encoding that translates to frame-rate ≥ 25 fps and available bandwidths of [3]: (1) $BW \leq 250$ kbps to (2) $BW \leq 384$ kbps (max 3G upload speed). For the lower bandwidth, we achieve a maximum PSNR of 29.7 dB (33.88 fps @ 226 kbps) while the second bandwidth gives a maximum of 31.9 dB (29.29 fps @ 363.53 kbps). Encoding delay was 0.426 seconds with 6 core Xeon@2.26 GHz (WPP streams / pool / frames: 18 / 6 / 2 for x.265 encoding).

We show an example of adaptive HEVC encoding to accommodate changing bandwidth in Fig. 1. In this example, we have an increase in available bandwidth from 250 kbps to 384 kbps (3G upload data rates). The video quality improved from 29.7 dB to 31.9 dB. The emergency video quality was found to be sufficiently good for determining the number of casualties, the total number of people and movements (see Fig. 1(b)). Future work will focus on fast methods for determining the Pareto front, and adaptation among additional models [3].

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