Chapter X
Comparison of Video Coding Standards Used in Mobile Applications

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ABSTRACT

This chapter gives description and comparison of video coding standards currently used in bandwidth limited mobile communications emphasizing at the same time the importance of coding efficiency and robustness, particularly for video applications. Due to its exceptional efficiency and performance a number of mobile service operators recognized and embraced relatively new H.264/AVC compression method. Utilization of this efficient compression method in the bandwidth limited and distortion prone mobile environment enables and provides transport of high quality video on low data rates. In order to demonstrate these abilities a comparison of H.264/AVC relative to MPEG-4 SP and H.263 method is presented. Comparison is performed using objective video quality assessment methods accompanied with description of different issues related to video quality measurement and its implication on coding process. Finally, comparison showed and confirmed great efficiency and performance possibilities, which will make H.264/AVC the ubiquitous coding technique of multimedia world in time to come.

INTRODUCTION

Although already designed and enhanced for high data rates and flexible communication capabilities, today's modern mobile telecommunication systems are experiencing growth of mobile user requirements for delivering of high quality multimedia information. Mobile users are used to being able to access different kind of rich multimedia content such as pictures, moving clips, movie trailers, animations or real time video streaming on their mobile terminals. Provision of this high quality multimedia information puts more demanding requirements on planning and designing of mobile communications systems for improving throughput, transfer delay, and data error rate.

Important issues arise from this situation. The first one is cost of services that forms and affects the acceptance and attractiveness of certain mobile applications, the second is the capacity of modern mobile communication channels, and the third is storage capability of mobile terminals. Access to rich multimedia content through the mobile network is very expensive since it requires high data rate point-to-point connection for each mobile user. The importance of mobile terminal storage capacity lies in the possibility to allow the time of information transmission to be decoupled from its time of use, thereby enabling the best possible economy of use of the available spectrum. Furthermore, large number of users and limited bandwidth capacity can cause system congestion that can lead to poor quality of service requiring network operators to carefully balance network traffic (Holma et al., 2007). Concerning the real time video distribution as an alternative to point-to-point oriented, limited and expensive mobile networks such as 3G (Kumar, 2007), new point-to-multipoint mobile systems were developed to enable and allow reception of video for a number of mobile users simultaneously without consuming limited channel resources (Kornfeld, 2004). Additionally, Faria (2006) describes how representatives of these new mobile networks employ techniques and spectrum of digital terrestrial broadcasting technology. There are several standards around the world designed for broadcasting to mobile terminals such as DVB-H (ETSI EN 302 304, 2001) and T-DMB/DAB (ETSI EN 102 427, 2005; ETSI EN 102 428, 2005). Probably a combination of technologies will be used together in order to provide interactivity and high quality of delivered rich multimedia content on mobile terminals as depicted in Jordan et al. (2006).

Nevertheless, regardless of used mobile system for efficient utilization of available transmission channel capacity and improvement of the quality of service, the appropriate coding method needs to be selected for mobile systems. Since video signal is composed of successive frames alternating in time domain, there is a high correlation present between neighboring image elements (pixels) inside and between successive frames. This means that the video has a large amount of spatial and temporal redundancy, which can be removed in order to reduce the irrelevant information and achieve the required transmission bit rate. Furthermore, while human visual system is less sensitive to higher spatial frequencies, these higher frequencies can be eliminated without any effects on subjective picture quality degradation (Zovko-Cihlar et al., 1998; Bauer et al., 1998).

To select the most efficient and robust video coding method for some application, a complete performance analysis of influence of compression on transferred video quality has to be made (Joch et al., 2002). This chapter analyses the effects of video compression methods on picture quality in low bit rate communication. Three video coding methods are tested: H.263 (ITU-T Rec. H.263, 2000), MPEG-4 SP (ISO/IEC 14496-2, 2000) and H.264/AVC (ITU-T Rec. H.264, 2005). The focus of this chapter has been on H.264/AVC coding technique, which is relatively new technique in mobile applications in comparison with H.263 and MPEG-4 SP coding techniques, already established in mobile environment. Two test