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Performance of High Efficiency Video Codec over Wireless Channels

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Abstract : Due to recent advances in wireless communication technologies and hand-held devices, there is a huge demand for video-based applications such as video surveillance, video conferencing, remote surgery, Digital Video Broadcast (DVB), IPTV, online learning courses, YouTube, WhatsApp, Instagram, Facebook, Interactive Video Games. However, the raw videos posses very high bandwidth which makes the compression a must before its transmission over the wireless channels. The High Efficiency Video Codec (HEVC) (also called H.265) is latest state-of-the-art video coding standard developed by the Joint effort of ITU-T and ISO/IEC teams. HEVC is targeted for high resolution videos such as 4K or 8K resolutions that can fulfil the recent demands for video services. The compression ratio achieved by the HEVC is twice as compared to its predecessor H.264/AVC for same quality level. The compression efficiency is generally increased by removing more correlation between the frames/pixels using complex techniques such as extensive intra and inter prediction techniques. As more correlation is removed, the chances of interdependency among coded bits increases. Thus, bit errors may have large effect on the reconstructed video. Sometimes even single bit error can lead to catastrophic failure of the reconstructed video. In this paper, we study the performance of HEVC bitstream over additive white Gaussian noise (AWGN) channel. Moreover, HEVC over Quadrature Amplitude Modulation (QAM) combined with forward error correction (FEC) schemes are also explored over the noisy channel. The video will be encoded using HEVC, and the coded bitstream is channel coded to provide some redundancies. The channel coded bitstream is then modulated using QAM and transmitted over AWGN channel. At the receiver, the symbols are demodulated and channel decoded to obtain the video bitstream. The bitstream is then used to reconstruct the video using HEVC decoder. It is observed that as the signal to noise ratio of channel is decreased the quality of the reconstructed video decreases drastically. Using proper FEC codes, the quality of the video can be restored up to certain extent. Thus, the performance analysis of HEVC presented in this paper may assist in designing the optimized code rate of FEC such that the quality of the reconstructed video is maximized over wireless channels.

Keywords : AWGN, forward error correction, HEVC, video coding, QAM
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