Public Abstract

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Title:Embedded System Design and Power-Rate-Distortion Optimization for Video Encoding under Energy Constraints

Wireless video communication over portable devices has become the driving technology of many important applications, experiencing dramatic market growth and promising revolutionary experiences in personal communication, gaming, entertainment, military, security, environment monitoring, and more. Portable devices are powered by batteries. Video encoding schemes are often computationally intensive and energy-demanding, even after being fully optimized with existing software and hardware energy minimization techniques. As a result, the operational lifetime of current portable video systems is still very short, mostly in the range of few hours. Therefore, one of the central challenging issues in portable video communication system design is to minimize the energy consumption of video encoding so as to extend the operational lifetime of devices. In this work, we develop an operational power-rate-distortion (P-R-D) approach to minimizing the video encoding energy under rate-distortion constraints. We analyzed the energy saving gain of P-R-D optimization; developed an adaptive scheme to estimate the P-R-D model parameters and performed on-the-fly energy optimization for real-time video compression. Our results show that, using the proposed P-R-D optimization technology, the encoder energy consumption can be significantly reduced. This has many important applications in energy-efficient portable video communication system design.