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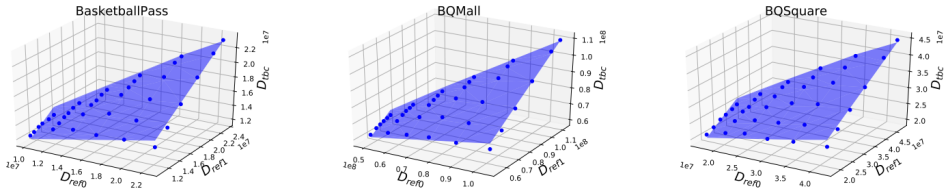
Adaptive Quantization Parameter Selection with Dependency Modelling for Versatile Video Coding

Communications & Information

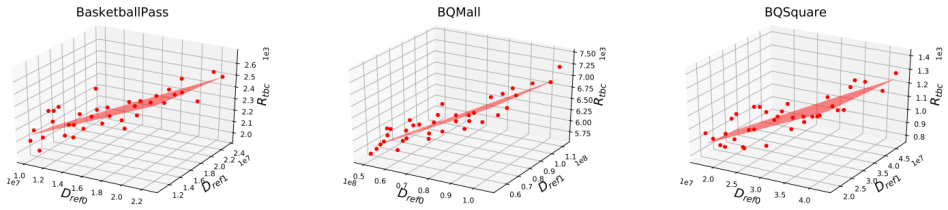
Computer/AI/Data Processing and Information Technology

Digital Broadcasting, Telecommunication and Optoelectronics



(a) BasketballPass with $baseQP = 32$ (b) BQMall with $baseQP = 32$ (c) BQSquare with $baseQP = 32$

Fig. 1 The variations of distortion of the to-be-coded frame as a function of the SSE of two reference frames.



(a) BasketballPass with $baseQP = 32$ (b) BQMall with $baseQP = 32$ (c) BQSquare with $baseQP = 32$

Fig. 2 The variations of the coding bits of the to-be-coded frame as a function of the SSE of two reference frames.

Opportunity

Currently there are numerous high-efficiency coding tools for Versatile Video coding (VVC) standards that are being implemented to improve coding performance. However, distortion of the reference frame in these tools can lead to inaccurate prediction and larger residuals in inter-prediction, and this influences distortion for the to-be-coded frames. If the reference and the to-be-coded frame share higher similarities, then there will be less distortion in the to-be-coded frame. Typically, the QP for each layer is fixed according to without any adaptation to the video content. This can lead to degradation in coding efficiency.

The technology presented here employs a two-pass global rate-distortion optimization (RDO) method that can significantly improve coding performance. Improvements in coding performance will have applications in video transmission and video storage.

IP Status
Patent filed

Technology Readiness Level (TRL) 4

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Develop Concept
Proof Concept
Follow-on Funding
Build Value

Technology

This technology optimizes video coding through a two-pass method. As a quantization parameter (QP) selection method, it improves on traditional QP configurations by exploring the dependency relationship between frames in first-pass coding and solving global RDO during second-pass coding. To be specific, during first-pass coding, this technology applies linear models to (1) the dependency between the distortion of the to-be-coded frame and the distortion of the reference frame and (2) the dependency between the bits of the to-be-coded frame and the distortion of the reference frame. During second-pass coding, this technology then decouples dependencies while providing optimal QP for each frame. Experimental results for the technology show a 1.82% average bitrate reduction for luma components.

This technology can therefore serve as a video codec that improves coding performance.

Advantages

- In comparison with current approaches to video coding using the VVC standard, this invention achieves significant gains in performance.

Applications

- The gains in coding performance produced by this invention are marked when coding short videos.
- Coding gains are also marked when coding videos with varied visual content.