מכון ויצמן למדע

THE WEIZMANN INSTITUTE OF SCIENCE

FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Vision and Robotics Seminar

Room 1 ,Ziskind Building
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System-Aware Compression: Optimizing Imaging Systems from the Compression Standpoint

Abstract:

In typical imaging systems, an image/video is first acquired, then compressed for transmission or storage, and eventually presented to human observers using different and often imperfect display devices. While the resulting quality of the perceived output image may severely be affected by the acquisition and display processes, these degradations are usually ignored in the compression stage, leading to an overall sub-optimal system performance. In this work we propose a compression methodology to optimize the system's end-to-end reconstruction error with respect to the compression bit-cost. Using the alternating direction method of multipliers (ADMM) technique, we show that the design of the new globally-optimized compression reduces to a standard compression of a "system adjusted" signal. Essentially, we propose a new practical framework for the information-theoretic problem of remote source coding. The main ideas of our method are further explained using rate-distortion theory for Gaussian signals. We experimentally demonstrate our framework for image and video compression using the state-of-the-art HEVC standard, adjusted to several system layouts including acquisition and rendering models. The experiments established our method as the best approach for optimizing the system performance at high bit-rates from the compression standpoint.
In addition, we relate the proposed approach also to signal restoration using complexity regularization, where the likelihood of candidate solutions is evaluated based on their compression bit-costs.
Using our ADMM-based approach, we present new restoration methods relying on repeated applications of standard compression techniques. Thus, we restore signals by leveraging state-of-the-art models designed for compression. The presented experiments show good results for image deblurring and inpainting using the JPEG2000 and HEVC compression standards.
* Joint work with Prof. Alfred Bruckstein and Prof. Michael Elad.
** More details about the speaker and his research work are available at http://ydar.cswp.cs.technion.ac.il/

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