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A nonlinear loop filter for quantization noise removal in hybrid video compression

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Abstract

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Abstract:

We propose a high-performance, nonlinear, loop filter that reduces quantization noise over video frames composed of locally uniform regions (smooth, high frequency, texture, etc.) separated by singularities. Unlike earlier work, the designed filter is not limited to block based transform coders and provides a robust solution for intra as well as differentially encoded frames. Our formulation based on sparse decompositions allows us to take advantage of the spatial dependencies inherent in video frames while incorporating temporal dependencies through the information provided by previously decoded frames. The proposed filter results in 10% improvements in rate (at typical distortions) in combination with significant visual quality improvements, especially around singularities.

Published in: IEEE International Conference on Image Processing 2005

Date of Conference: 14-14 September 2005

DOI: 10.1109/ICIP.2005.1530059

Date Added to IEEE Xplore: 14 November 2005

Publisher: IEEE

Print ISBN: 0-7803-9134-9

Conference Location: Genova, Italy

► ISSN Information:

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1. Introduction

Loop filters for hybrid video compression have regained popularity as part of recent high performance video compression standards [8], [7]. While they can be deployed in various forms to address different needs, the filters of primary interest here are used to reduce quantization noise/artifacts from decoded frames. In such a capacity, the filtered frames serve not only as the final decoded output but they are also used in the prediction loop, allowing the motion compensated prediction process to be based on a better anchor (Figure 1).

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