Implementation of Iterative Reconstruction of Images from Multiple Bases Representations

by

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(ABSTRACT)

Usually, image compression techniques that use only one transform exhibit some poor properties. For instance, the Discrete Cosine Transform (DCT) cannot efficiently represent high frequency components, resulting in blurred images. The Multiple Bases Representation (MBR) compression technique, which uses two or more transforms, is found to be superior to the single transform techniques in terms of representation efficiency. However, some bits in the MBR representation are needed to track the basis information. The MBR image quality is deteriorated by discontinuities at block boundaries, as is the standard DCT transform.

In this thesis, test images are distorted by MBR compression using a Recursive Residual Projection algorithm. This algorithm is a sub-optimal method to find the best basis vector subset for representing images based on multiple orthogonal bases. The MBR distorted images are reconstructed by the iterative method of Projection onto Convex Sets (POCS). Many constraints that form convex sets are reviewed and examined.

Due to the high distortion at the block boundaries, some constraints are introduced particularly to reduce artifacts at the boundaries. Some constraints add energy to the reconstructed images while others remove energy. Thus, the initial vectors play a key role in the performance of the POCS method for better MBR reconstruction. This thesis also determines the most appropriate initial vector for each constraint.

Finally, the composite projections associated with the sign, minimum decreasing and norm-of-slope constraints are used to improve the reconstruction of the MBR distorted images and the effect of ordering of the projections is investigated.

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