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Optimal Image Representation for Linear Canonical Transform Multiplexing

Authors : Navdeep Goel, Salvador Gabarda

Abstract : Digital images are widely used in computer applications. To store or transmit the uncompressed images requires considerable storage capacity and transmission bandwidth. Image compression is a means to perform transmission or storage of visual data in the most economical way. This paper explains about how images can be encoded to be transmitted in a multiplexing time-frequency domain channel. Multiplexing involves packing signals together whose representations are compact in the working domain. In order to optimize transmission resources each 4x4 pixel block of the image is transformed by a suitable polynomial approximation, into a minimal number of coefficients. Less than 4*4 coefficients in one block spares a significant amount of transmitted information, but some information is lost. Different approximations for image transformation have been evaluated as polynomial representation (Vandermonde matrix), least squares + gradient descent, 1-D Chebyshev polynomials, 2-D Chebyshev polynomials or singular value decomposition (SVD). Results have been compared in terms of nominal compression rate (NCR), compression ratio (CR) and peak signal-to-noise ratio (PSNR) in order to minimize the error function defined as the difference between the original pixel gray levels and the approximated polynomial output. Polynomial coefficients have been later encoded and handled for generating chirps in a target rate of about two chirps per 4*4 pixel block and then submitted to a transmission multiplexing operation in the time-frequency domain.

Keywords : chirp signals, image multiplexing, image transformation, linear canonical transform, polynomial approximation
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