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Numerical Analysis of Diagonal Preserving, Ripple Minimizing and Low-Pass Image Resampling Methods

by/par

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Abstract

Image resampling is a necessary component of any operation that changes the size of an image or its geometry. Methods tuned for natural image upsampling (roughly speaking, image enlargement) are analyzed and developed with a focus on their ability to preserve diagonal features and suppress overshoots. Monotone, locally bounded and almost monotone "direct" interpolation and filtering methods, as well as face split and vertex split surface subdivision methods, alone or in combination, are studied. Key properties are established by way of proofs and counterexamples as well as numerical experiments involving 1D curve and 2D diagonal data resampling. In addition, the Remez minimax method for the computation of low cost polynomial approximations of low pass filter kernels tuned for natural image downsampling (roughly speaking, image reduction) is refactored for relative error minimization in the presence of roots in the interior of the interval of approximation and so that even and odd functions are approximated with like polynomials. The accuracy and frequency response of the approximations are tabulated and plotted against the original.

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