Image noise can occur during image acquisition, transmission or storage. Noises in images are caused by many factors such as atmospheric or intermediate media in-homogeneity and relative motion between the object and the camera. An application of wavelet transform is noise suppression in signals; image signals inclusive. The wavelet transform of a noisy color image has 2D wavelet coefficients for each of the red, green and blue channels. The 2D wavelet coefficients are grouped into Approximation part and Details part. The coefficients in the Details part with values less than a threshold value represent the noise content. For the purpose of noise suppression, Threshold Shrinkage Functions are used to modify the coefficients in the Details part. Experiments on image noise suppression capability of Hard Threshold Shrinkage Function (HTSF), Soft Threshold Shrinkage Function (STSF), Hyperbola Threshold Shrinkage Function (HYTSF), Garrote Threshold Shrinkage Function (GTSF) and Modified Garrote Threshold Shrinkage Function (MGTSF) are presented. Six types of noise are considered. Noise suppression in the wavelet domain by the five wavelet threshold shrinkage functions is compared with noise suppression in the spatial domain by the Gaussian Filter (G), Median Filter
Experiments on the Capability of Wavelet Domain Noise Suppression: Comparison with Spatial Domain Noise Suppression

(MDN), Alpha-Trimmed Mean [4 Pixels Excluded] Filter (AT4P), Mean Filter (MEAN) and Texture Synthesis Adaptive Median Filter (TSBAMF). Optimum threshold value is obtained with the logarithm in the universal threshold equation taken to base 10. MGTSF and GTSF are found to be the best wavelet de-noising schemes for the suppression of Poisson noise and Speckle noise respectively. HYTSF is found to be the best wavelet de-noising scheme for both the Localvar noise and the Gaussian noise. Wavelet de-noising is recommended to be limited to first decomposition level as filtered images at higher decomposition levels are marred with blurring and undesirable edges. Wavelet de-noising is found not suitable for the suppression of Random Valued Impulse noise and Salt & Pepper noise; spatial domain de-noising is highly effective for both noise types. Suppression of Localvar noise, Poisson noise, Gaussian noise, and Speckle noise is found to yield good results in the wavelet domain but yield better results in the spatial domain.

References


Index Terms

Computer Science

Signal Processing
Keywords

Image noise, Wavelet transform, Threshold shrinkage functions, Spatial domain filters, Peak signal to noise ratio.