# A NOVEL STATISTICAL IMAGE FUSION RULE FOR NOISY SOURCE IMAGES

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Image fusion is an emerging area of statistical application that deals with the integration of images captured by multiple sensors or different modes of imaging systems to obtain an image having higher information content than the individual images. A practical limitation of existing fusion algorithms is that the input images are often assumed to be noise-free. This paper presents a new statistical image fusion technique using the coefficients of discrete wavelet transform (DWT) of noisy source images. The main feature of the proposed method is that it takes into account the statistical dependency between the wavelet coefficients of noisy source images as well as the noise-free fused image using a locally adaptive joint probability density function. The density function is then used in the Bayesian maximum a posteriori (MAP) estimation technique to derive a closed-form estimator for the noise-free wavelet coefficients of the fused image. To alleviate the problem of shift-variance property of traditional decimated DWT in a computationally efficient way, the proposed algorithm is implemented using the technique of cycle-spinning. Results are presented for the experiments carried out on a large number of test images to evaluate the performance of the proposed MAP-based method as compared to commonly-used fusion methods. Comparisons are made with respect to standard performance metrics such as the structural similarity, peak signal-to-noise ratio, and cross-entropy.

**Key Words:** Bayesian MAP estimation, Discrete wavelet transform, Locally-adaptive joint PDF