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# Wiener Filter-based Wavelet Domain Denoising

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**Abstract:** The wavelet domain Wiener filter has been widely adopted as an effective image denoising method that has low complexity. In this paper we propose a novel Wiener filter with high-resolution estimation that determines the signal power while preserving the edge information. We assume that a noisy image is composed of noise and the original image, which are mutually orthogonal. Based on this assumption, we utilize the local covariance to obtain high-resolution coefficients from the low-resolution coefficients and to estimate the signal variance in the Wiener filter by using the high resolution values. The experimental results show that the proposed algorithm improves the objective and subjective performance significantly.

**Key words:** Wiener filter, image denoising, high resolution estimation.

## 1. Introduction

Image denoising is the recovery of a digital image that has been contaminated by additive zero-mean white Gaussian noise during its acquisition and transmission. The need for effective image restoration algorithms has grown with the massive production of digital images and movies of all kinds, which often are acquired under poor conditions. The goal of image denoising is to eliminate the noise and preserve the edge and texture detail to remove artifacts visible to the human eye by reconstructing the original image from the distorted image.

Over the last decades, many algorithms have been proposed for high-quality denoising performance. Among them, discrete wavelet transform (DWT) has been widely used for noise removal in the field of image processing [1-13]. The success of DWT is due to the fact that DWT can be applied to a sparse representation of the image, which means that many of the coefficients are close to zero. In the wavelet domain, the noise is uniformly spread throughout the high frequency coefficients, while, most of the image information

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