WIENER FILTER IN TWO DIMENSIONNAL CASE APPLIED TO RESTORDED IMAGES

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ABSTRACT :

In high frequency propagation, the design of a two-dimensional Wiener filter is based on the principle of orthogonality, while being based on three following assumptions:

1. the filter used is linear and invariant.
2. the desired exit and input signal X(m,n) Z(m,n) are jointly stationary.
3. the criterion of minimization used is that of the minimal average quadratic error between the desired exit Z(m,n) and the current exit Y(m,n).

The filter of two-dimensional Wiener is a generalization of the filter of unidimensional Wiener.
Modern digital technology has made it possible to manipulate multi-dimensional signals with systems that range from simple digital circuits to advanced parallel computers[1,2]. The theory of Wiener gives the filter which minimizes the residual error (difference between the real exit and the desired exit), thus, the filter of Wiener 2D gives a solution to many problems of two-dimensional signal processing such as the restoration of degraded images. However, since the determination of this filter implies the solution of a linear equations system with great dimension, fast algorithms are necessary. The effort of calculation for the determination of the coefficients of this filter depends primarily on the statistical nature of the input signal.
Further, we will restrict ourselves to two-dimensional (2D) image processing although most of the concepts and techniques that are to be described can be extended easily to three or more dimensions. The Wiener filter is a solution to the restoration problem based upon the hypothesized use of a linear filter and the minimum mean-square (or mms) error criterion. In the example given below the image a[m,n] was distorted by a bandpass filter and then white noise was added to achieve an Signal/noise ratio equal to 30 dB[3,4].

KEY WORDS :
Digital images, Fourier transform, sampling, Wiener filter, noise.