Abstract

The filtering of noisy images while preserving image details is of great importance in digital image processing. In this thesis we present a study of detail-preserving adaptive morphological filters. The filters described, are capable of removing various types of noise, taken separately or as a combination and yield results superior to the traditional filters of their class.

We define the concept of line of least variance (LLV) morphology, and use this concept in conjunction with statistical morphology to develop additive noise statistical morphological filters. Also, we outline an approach for obtaining the probabilities of structures based on the second order statistics of predefined lines of the structuring elements. From this we outline concepts for estimating pixel weights for spatial filters in a manner somewhat similar to the classical Wiener filter algorithm.

The filtering of impulsive noise is considered using the selective application of erosion and dilation. In order to implement these filters we introduce the concepts of sub-erosion and sub-dilation, using sub-structuring elements. In the thesis we outline the theory for selecting the optimum sub-erosion or sub-dilation values.

Finally, using concepts of LLV morphology and sub-structuring elements, we

introduce the concept of linear combinatorial morphology. We use this concept to develop the generalized morphological homomorphic filter. This filter is based on the new concepts of linear combinatorial opening and closing, and is capable of removing a combination of additive, impulsive, and multiplicative noise from images.