Abstract

Images are rich information carriers and (such as medical images) are normally contaminated by additive and substitutive noise which makes the extraction of features (and clinical data analysis) difficult. Hence to enhance the image quality prior to post processing, image pre-processing operations such as de-noising with linear and non-linear filters have been applied traditionally. Recently nonlinear filtering techniques have been assumed a lot of significance as they are capable of suppressing the effects of substitutive (salt and pepper impulsive noise of low to high noise levels) and additive (Gaussian noise of low to medium noise levels) noise types and to preserve the important signal/image details such as edges and fine details and suppress the degradations occurring at the time of image/signal formation or transmission through nonlinear channels, during storage and retrieval. Broadly speaking, image filters exist in transform and spatial domains. Spatial domain nonlinear filters are more versatile than their counterparts, namely linear filters. Spatial domain nonlinear fuzzy classical filters are simply modification/extension of the classical median and moving average filtering approaches, offer several advantages over classical nonlinear filters, and using simple fuzzy rules it is easy
to realize them. They are also capable of reasoning with vague and uncertain information. Work presented in this paper deals with nonlinear median based and linear average based fuzzy filters and aims at fulfilling three objectives, viz; (i) To systematically study the performance of classical nonlinear median and fuzzy median and average filters for the removal of impulse and Gaussian noise from gray and color images that have been corrupted from low to high values of noise and to present an experimental review to identify the best algorithm within the frame work of classical fuzzy median filters. (ii) To propose: (a) an impulse classifier based fuzzy switching median filter and (b) the design of a multi pass cascaded fuzzy filter for noise cancellation, and explore their applications to reduce noise in images with random and impulse characteristics. Finally to conclude the work a comparative study is done and the computational aspects are analyzed with the help of mean square error (MSE), peak signal to noise ratio (PSNR), and 2D correlation (COR) and some future solutions are proposed.

References

Index Terms

Computer Science  Fuzzy Systems

Keywords