FUZZY RANDOM IMPULSE NOISE REDUCTION TECHNIQUE BASED ON STATISTICAL ESTIMATORS

SOHAIL MASOOD[1], AYYAZ HUSSAIN[2], M. ARFAN JAFFAR[1,3]
ANWAR M. MIRZA[1] AND TAE-SUN CHOI[3]

[1]Department of Computer Science
National University of Computer and Emerging Sciences
Islamabad, Pakistan
rsmbhatti@yahoo.com; anwar.m.mirza@gmail.com

[2]Department of Computer Science
International Islamic University
Islamabad, Pakistan
ayyaz.hussain@iiu.edu.pk

[3]Department of Mechatronics
Gwangju Institute of Science and Technology
Gwangju, South Korea
{ arfanjaffar; tschoi }@gist.ac.kr

ABSTRACT. *In this paper, a novel image restoration technique based on fuzzy logic and robust order statistics is presented. The proposed method uses the concept of robust order statistics, median and MAD (median of the absolute deviations from the median) along with fuzzy logic. We use the median and MAD to construct trapezoidal shaped fuzzy membership function which has major participation in noise reduction and detail preservation of images which are corrupted with high degree of random valued and mixed impulse noise. Extensive experiments are performed to prove that the proposed method gives higher performance compared to recent noise removal methods particularly if the noise density becomes more than 40% for both types of noises. The experimental results are based on well-known global as well as local quantitative measures which includes peak-signal-to-noise-ratio (PSNR) and structural similarity index measure (SSIM).*
Keywords: Fuzzy filter, Impulse noise, Statistical estimators, Random valued impulse noise, Mixed impulse noise

1. **Introduction.** Image restoration is an important branch of image processing, which deals with the reconstruction of images by removing noise and blurriness, and making them suitable for human perception. Images can become corrupted during any of the acquisition, pre-processing, compression, transmission, storage and/or reproduction phases of processing [21, 22, 23, 24]. Liu and Li, in their reviews [25], have divided spatial image restoration techniques into two broad categories named conventional and blind image restoration. In the first category, the techniques are used to solve motion blur, system distortions, geometrical degradations and additive noise problems. Information about the degradation process is generally known in these cases. This known information can be used in developing a model which can be used to restore the corrupted image back to its original form. Unfortunately, details about the degradation process are unknown in most of the cases, which make the image restoration process more demanding. Recently, more focus has been placed on the second category of image restoration [25], where the image has to be restored directly from the degraded image without any prior knowledge