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DETAIL PRESERVING FUZZY FILTER FOR IMPULSE NOISE REMOVAL

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Abstract. *In this paper, we propose fuzzy based image filtering technique to remove the impulse noise while preserving the image details for low as well as highly corrupted images. The proposed filter is based on noise detection, fuzzy parameter identification, fuzzy mean estimation, intensity estimation, fuzzy decision making and embedded intelligent fuzzy control. The main advantage of the proposed technique over the other filtering techniques is its marvelous noise removal as well as detail preserving capability. Experimental results demonstrate that the proposed technique achieves much better performance than the state-of-the-art filters. The comparison of the results is based on both the global error measures i.e. Mean-Square-Error (MSE) and Peak-Signal-to-Noise-Ratio (PSNR) and a local error measure i.e. Structural Similarity Index Measure (SSIM).*
Keywords: Image restoration, Fuzzy logic, Structure similarity index, Fuzzy control, Fuzzy decision, 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 be corrupted during any of the acquisition, pre-processing, compression, transmission, storage and/or reproduction phases of processing [1-3,13]. Liu and Li, in their reviews [12], 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 [12], where the image has to be restored directly from the degraded image without any prior knowledge of degradation. One of the main tasks in developing such image restoration techniques is noise removal along with preserving the image details. Smoothing a region of the degraded image might destroy an edge while sharpening edges might lead to amplification of unnecessary noise. In the sequel, we present a new spatial filtering technique, based on fuzzy logic control to remove noise while efficiently preserving the image details.