Multistage Filtering Algorithm for Salt and Pepper Noise Removal from Highly Corrupted Microscopic Blood Images

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***Abstract*—Image quality mainly affects the performance of any medical image processing system. Salt & pepper noise is one type of noise that significantly degrades the image quality. Such noise can be frequently encountered in digital microscopic images due to technical reasons. Moreover, high ratios of Salt & pepper noise make the image excessively corrupted or unreadable. Standard and modified median filters can usually handle low/medium Salt & Pepper noise densities, mostly at the expense of edge/details preservation. However, they totally fail for highly corrupted images where noise density reaches 90%. In this paper, we present a new multistage filtering algorithm for Salt & pepper noise reduction from highly corrupted images while preserving image details and edges as better as possible. The proposed algorithm includes two filtering stages through which image is firstly de-noised via utilizing adaptive median filter then decision based median filter. Our multistage filter has been successfully applied on noisy microscopic blood images obtained from Malaria-infected blood smears. Results reveal that the presented filtering algorithm outperforms standard and modified median algorithms in terms of PSNR, MSE and IEF values, specifically for images with more than 80% of salt & pepper noise. This indicates that using our multistage filtering algorithm against high Salt & Pepper noise densities, does not only remove the noise effectively but also achieves a better edge and details preservation, hence a better image enhancement.**

***Index Terms*: salt & pepper noise, high noise density, spatial filtering algorithms, Standard Median Filters, Adaptive Median Filter, Decision Based Median Filter, Multistage Filter.**

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