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High Density of Noise Removal Using FBD Filter

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Abstract*—This research work has been done on data mining for noise type detection and filtering process to ample more effectiveness for removing the noise content in an image. In this article we have proposed a scheme of data mining based on filtering techniques. In this paper, improved bilateral filter is used for the removal of high density Gaussian noise, decision based alpha trimmed for the removal of high density salt and pepper noise and FBD (Fuzzy–Bilateral-DBMF) Filter for the removal of these above two noises present in the colored images . The experimental results computed on MATLAB software with Image Processing toolbox. Mean square error, Root mean square error and Structure Context are major source of focus for the performance evaluation of the colored images.
***Keywords*—Data mining, Bilateral filter, Decision Based Alpha Trimmed Median Filter, (FBD) Fuzzy–Bilateral-DBMF Filter**

I. INTRODUCTION

The data mining system [1] is helpful to check requirements commotion or various noises available in the image. There are diverse types of clamors or noises that may be available in the pictures, for instance, Gaussian noise, salt and pepper noise and their mixture. These noises can often be shaped by the original sensors, hardware of scanner or if discernment is obtained because of the real camera. Before any subsequence managing simply like edge preservation or it could be protest acknowledgment, you will need to expel unsettling influence from unique image [2].

Data mining is definitely the act of quickly looking outlets of information for getting patterns that surpass standard investigation. Data mining makes by using modern scientific calculations to portion the information and assess the specific likelihood of upcoming occasions.

In this paper for noise detection, the process such as fuzzy rule-base generation is used. Take assumption such as the M(X) = $[M_1, M_2, M_3]$ as well as N(Y) = $[N_1, N_2, N_3]$ are the set of linguistic labels for attribute X and Y respectively. First for the calculation of M_1, we need the degrees of support for the respective pairs such as $[M_1, N_1], [M_1, N_2]$ *and* $[M_1, N_3]$. In order to select a subspace of fuzzy having the degree of support at maximum level. Repeating this process for M_2 , M_3 the following fuzzy rules for G (1), G (2) and G (3) are obtained using fuzzy logic.

Now focus on the G (1) rulebase [3], i.e. the group of rules having N_1as the consequent. Then the conclusion is that the noise type is Gaussian noise. Now focus on the G (2) rulebase [3], i.e. the group of rules having N_3as the consequent. Then the conclusion is that noise type is salt and pepper noise [4].

$$G(1) = \text{IF } (X, M_i) \text{ THEN } (Y, N_1), \quad i=1, 2, 3$$

$$G(2) = \text{IF } (X, M_i) \text{ THEN } (Y, N_3), \quad i=1, 2, 3$$

When the consequents of the fuzzy rules are not identical, i.e., various combinations such as $[N_1, N_2, N_3)]$ {except G (1), G (2)} appear in the THEN part, here the type of noise is mixed one. In such a case, the proposed FBD (fuzzy-bilateral-DBMF) filter will be applied to remove all noises from images.

$$G(3) = \begin{Bmatrix} \text{IF } (X, M_1) \text{THEN } (Y, N_i), & \text{i, j, k} = 1, 2, 3 \\ \text{IF } (X, M_2) \text{THEN } (Y, N_j), & \text{i, j, k} = 1, 2, 3 \\ \text{IF } (X, M_3) \text{THEN } (Y, N_k), & \text{i, j, k} = 1, 2, 3 \end{Bmatrix}$$

II. NOISES

Noise is generally a random variation linked to image Intensity as well as visible as grains on the image. It may arise on the image as connection between basic physics-like photon mechanics of light in addition to thermal energy of heat in the image sensors. It could produce before recording or impression sign. Noise implies, the pixels on the image show distinctive intensity values as an option to true pixel ideas. Noise removal algorithm could be the process of getting rid of or reducing the noise on the image. The

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noise therapy algorithms reduce or eliminate visibility of appears by smoothing the entire image leaving locations near contrast edge. But these procedures can obscure acceptable, low contrast information [5].

Images acquired through modern sensors can be contaminated by many noise sources. By noise we make reference to stochastic variations instead of deterministic distortions for example shading or insufficient focus. Here there is a simply assumption for this section that have been dealing with images formed from soothing using modern electro-optics. In particular assumption of using the modern, charge-coupled device (CCD) digital cameras which are often called photoelectrons. Nevertheless, almost all of the observations regarding noise and its particular various sources preserve equally well designed for other imaging techniques [6].

III. DATA ANALYSIS

This is the major section of this research paper that depicts that this existed proposed method is the best method than available methods of image processing. Performance is measured over the Parameters: Mean square error, Root mean square error and Structure Context [7].

A. MSE (Mean Square Error)

Mean square error is to compute an error signal by subtracting the test signal from the reference, and then computing the average energy of the error signal.

TABLE I
MEAN SQUARE ERROR

Input Image	Median Filter	Mean Filter	FMM Filter	Bilateral Filter	DBMF Filter	FBD Filter
1.	4177	1644	3817	71.3350	39.183	47.54
2.	4066	1900	3942	168.392	71.966	100.9
3.	3324	3852	4785	160.764	109.09	98.26
4.	3576	3054	4409	214.087	93.495	127.9

Table I: Here values of proposed filters are low, which means image quality is usually high. The noisy image have Gaussian noise is 0.2, impulse noise is 0.3

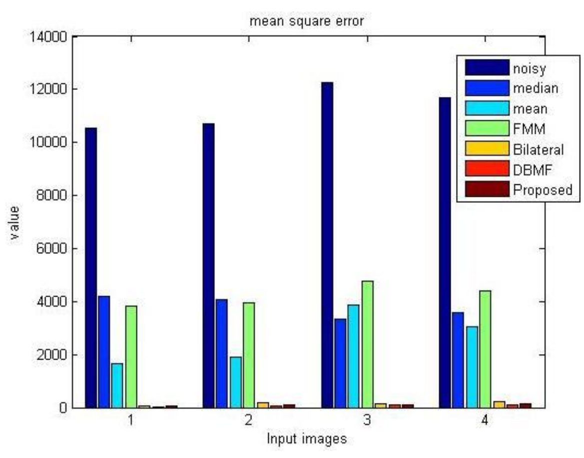

Fig. 1 Mean Square Error graph for colored images

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From the Fig. 1, it is quite clear that the efficient results of proposed method are obtained for all the four colored images of different size and format. The proposed filters (FBD) shows the lower values for MSE than all existing filters (FMM).

B. RMSE (Root-Mean-Square Error)

Root-mean-square error is a measure of the differences between values predicted by a model or an estimator and the values actually observed.

TABLE III
ROOT MEAN SQUARE ERROR

Input Image	Median Filter	Mean Filter	FMM Filter	Bilatera l Filter	DBMF Filter	FBD Filter
1.	64.6297	40.54	61.78	8.4460	6.2596	6.895
2.	63.7652	43.58	62.79	12.9766	8.4833	10.04
3.	57.6541	62.06	69.17	12.6793	10.444	9.912
4.	59.7997	55.26	66.40	14.6317	9.6693	11.31

Table II: Here values of proposed filters are low, which means image quality is usually high. The noisy image have Gaussian noise is 0.2, impulse noise is 0.3

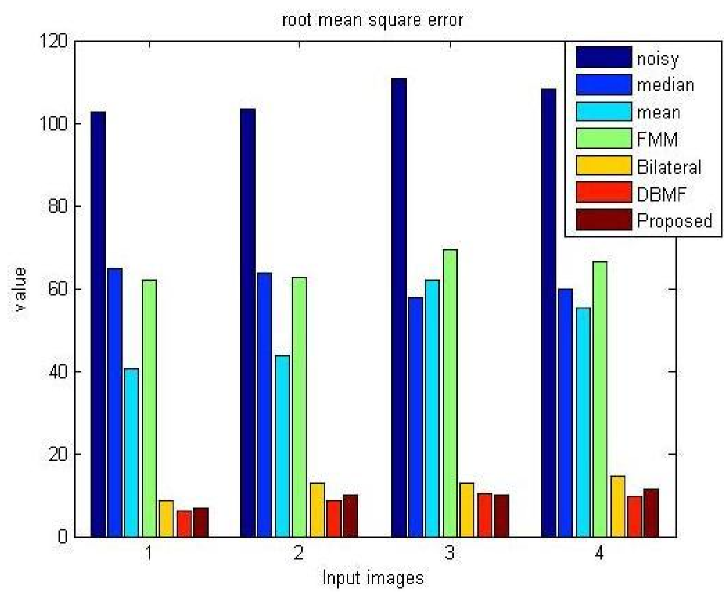

Fig. 2 Root Mean Square Error graph for colored images

From the Fig. 2, it is quite clear that the efficient results of proposed method are obtained for all the four colored images of different size and format. The proposed filters (FBD) shows the lower values for RMSE than all existing filters (FMM).

C. SC (Structure Context)

This measure effectively compares the total weight of an original signal to that of a coded or given. It is a global metric; localized distortions are missed.

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TABLE IIIII
STRUCTURE CONTEXT

Input Image	Median Filter	Mean Filter	FMM Filter	Bilatera l Filter	DBMF Filter	FBD Filter
1.	0.0155	0.024	0.016	0.1184	0.1598	0.145
2.	0.0157	0.022	0.015	0.0771	0.1179	0.099
3.	0.0173	0.016	0.014	0.0789	0.0957	0.100
4.	0.0167	0.018	0.015	0.0683	0.1034	0.088

Table IVII: Here values of proposed filters are high, which means image quality is usually high. The noisy image have Gaussian noise is 0.2, impulse noise is 0.3

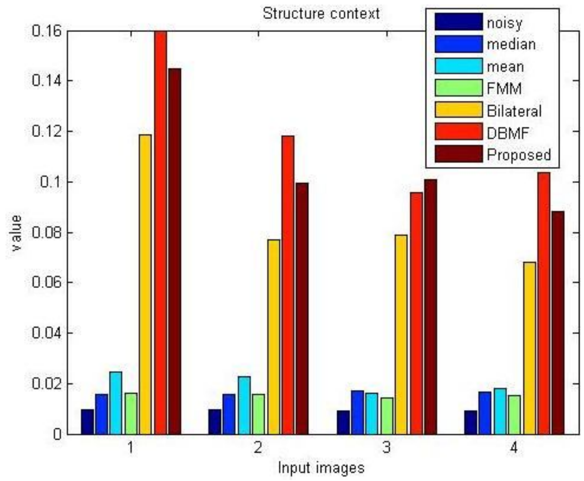
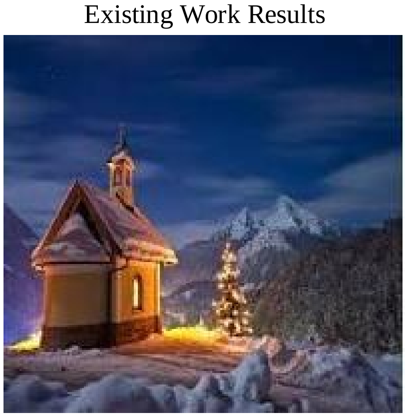


Fig. 3 Structure Context graph for colored images

From the Fig. 3, it is quite clear that the efficient results of proposed method are obtained for all the four colored images of different size and format. The proposed filters (FBD) shows the higher values for SC than all existing filters (FMM).

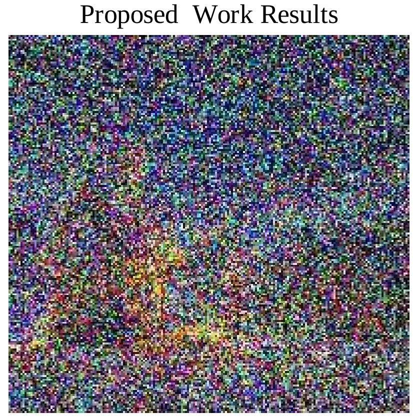
IV. RESULTS

Existing Work Results



(i) Input image

Proposed Work Results



(ii) Noisy image

(iii) Mean filter for Gaussian Noise

(iv) Bilateral filter for Gaussian Noise

(v) Median filter for Impulse Noise

(vi) DBMF filter for Impulse Noise

(vii) FMM filter for Mixed Noises

(viii) FBD filter for Mixed Noises

Fig. 4 Results of colored images

These experimental results shows that outputs of the filters with high noise density of (a) Gaussian noise = 0.2 (b) Impulsive noise = 0.3 in Fig. 4. The experimental results of various colored images are shown by using existing filters such as mean filter which removes Gaussian noise, median filter which removes impulse noise, (FMM) fuzzy-mean-median filter which removes mixed noises (Gaussian noise & impulse noise). These experimental results also shows the output of the colored images by using proposed filters improved bilateral filter which removes Gaussian noise and (DBMF) decision based alpha trimmed median filter which removes impulse noise and improved fuzzy filter (FBD) filter which removes mixed noises (Gaussian noise & impulse noise).

V. CONCLUSIONS

Various sorts of colored images are taken for experimental purposes. For the implementation of the proposed technique, the MATLAB tool alongside assistance from image processing toolbox is used. This FBD filter for the reduction of high density of mixed noises, improved bilateral filter for the reduction of high density Gaussian noise and decision based alpha trimmed median

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filter for the reduction of high density impulse noise shows results which are quiet effective and cleared than the previous filters. These FBD filters remove noises at the great extent and also the edge preservations of colored images has been done.

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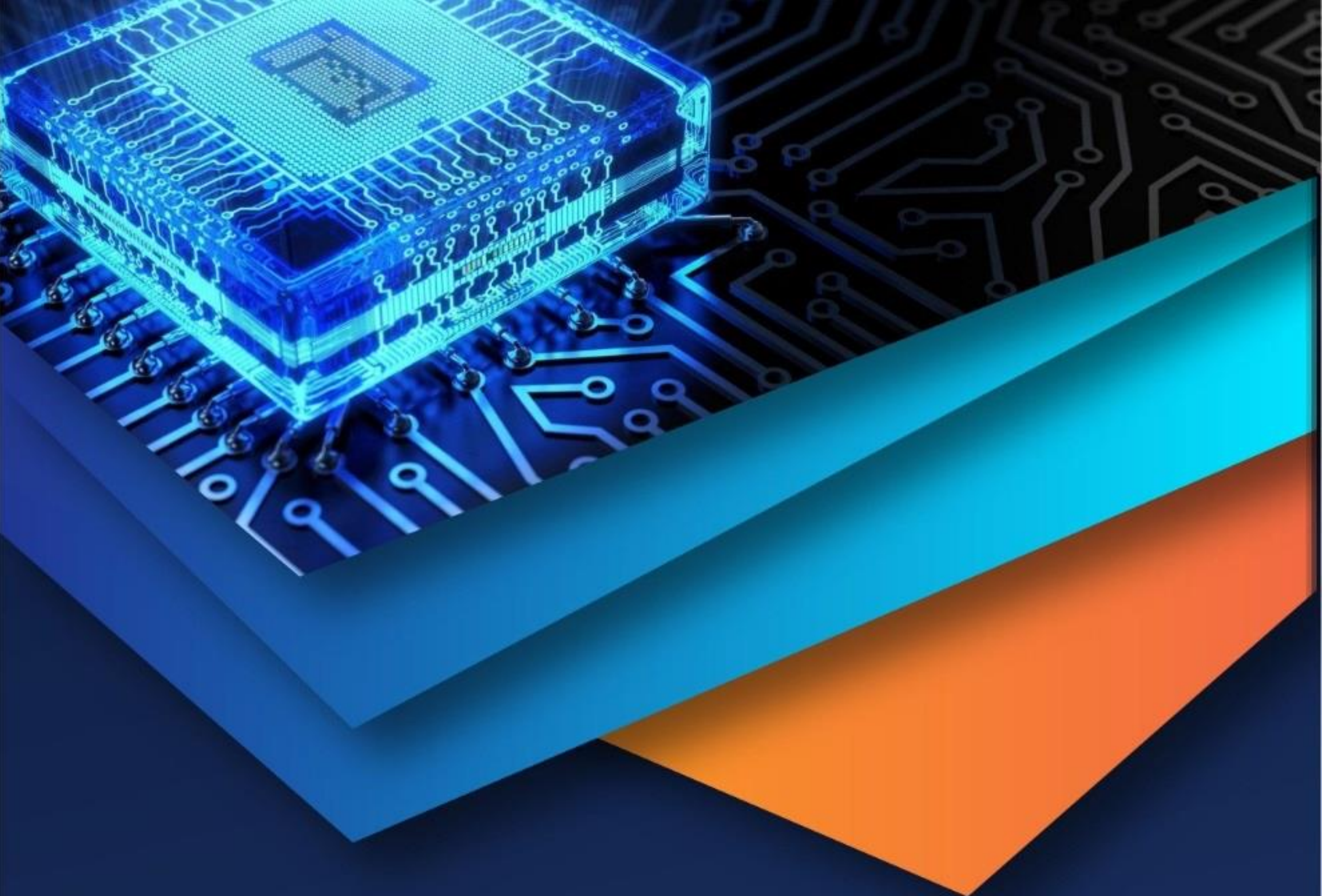

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