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An Effective Image retrieval Using Novel Wavelet Based Quaterian Median Filter

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Abstract

In Image processing, noise is the foremost irritating problem. Generally images are degraded because of the impulse noise which was created during the faulty pixels in the camera sensors or locations of the defective memory in hardware. There are so many sources are causing the noises in the images. Still, Image de-noising is a tremendous research area. Feature extraction is the process where the color and texture features are extracted. Different methods are there for extracting the color and texture features. Still there is a challenge in the area of extracting best features. The purpose of this work is to acquire effective results without noise using novel WBQMF method in image retrieval process. In this proposed work, the experiments is carried to suppress the Random Valued Impulse Noise (RVIN) and salt and Pepper Noise (SPN) and in high level of noise density images. This work proposes an innovative Wavelet Based Quaterian Median Filter (WBQMF). The PSNR (DB) Results BM3D, WNNM, TNRD, DnCNN, FFDNet Methods on Set12 Dataset with various Noise Levels. Thus the developed WBQMF shows the improved results in terms of Peak Signal to Noise Ratio (PSNR) in various kind of images. And also in our proposed approach, color histogram, modified GLCM and statistical features are the methods used for extracting best color and texture features. A novel CNN is employed for the structure of classification and machine learning approach. A WBQMF on corel 1K dataset acquires better ARR and APR rate when compared with traditional approaches such as LTrP, LOOP, LDP and LMDep.

Finally, the WBQMF is compared with the existing methods.

Keywords: De-noising, Salt and Pepper Noise, Wavelet Based Quaterian Median Filter, Random Valued Impulse Noise.

1. INTRODUCTION

Denoising is a basic one at the same time, it is demanding field which is significant in the image processing Chen, et al. (2015). Noise corrupted images have depraved features Zhang and Li (2014)which is not suitable for use directly for the succeeding image processing for example recognition, segmentation and retrieval. The impulse noise (IN), is one of the most commonly faced noise issue. This is mostly applied into images through the process of inadequate acquisition, bit errors occurs in analog-to-digital changes and transmission errors. The aim of denoising process is mainly to eliminate the noises at maximum level when preserving the details of the images. To reduce the Salt and Pepper noise and IN, there are so many kind of methods are already developed. In these methods, the median filter (MF) is extensively utilized approach because of its easiness. The drawback of MF is having deprived denoising capability meanwhile it is just interchanges the every pixel intensity and the local median value. The developed MF is weighted median filter (WMF) and the center weighted median (CWM) filter. Even these approaches are not thoroughly suppress the IN due the characteristics of the reform of all pixels indifferently.

Deng, et al. (2016) Presented a method for de-noising by deploying the multilayered Pulse Coupled Neural Network (PCNN). This improved PCNN's firing aspects have been analyzed by setting the parameters of PCNN adaptively according to the removal of "Mathematics Firing". By this approach, the salt and pepper noise have been located. An improved median filter was used to govern the median. This was achieved by using the uncontaminated pixels. At last, the fluctuating density salt and pepper noise was removed by iterating the location of noise and noise removal. The simulation results have been shown improved performance when compared with the existing approaches. Irum, et al. (2015) Collected the morphological standard sequences by proposed filter. It has been eliminated the permanent impulse noise (salt & pepper) effectively, without altering the features, edges, and components of image. In case of high noise densities, this approach does not lead distorting and moving effects. The typical similarity measures have been measured to estimate the proposed hybrid filter performances. Fu, et al. (2018) Proposed an algorithm for image denoising which is mainly for salt and pepper noise. Initially, reproductive algorithm has been built a fundamental unit such as patch unit. The image noise has been located the algorithm inside the patch by means to define the path and also for acquire the efficient clustering. Next, the proposed algorithm has been classified the patches by utilizing the reproductive algorithm. Hence, it was delivered the furthermore noise repair similarity information's and reducing the noise interference. The salt and pepper noise has been removed through a non-local switching filter which was constructed by the proposed algorithm. The simulation outcomes have been shown the proposed algorithm effectiveness in removing the salt and pepper noise in various densities.

Fu, et al. (2018) Proposed a contour prior denoising based on patch approach for salt and pepper noise. Initially, noise image was converted into patches, a distinct cumulative

deviation framework have been designed by means to remove the contour structures. The most like patches are searched by the design of weighted Euclidean distance. From the similar patches, contour stencils have been extracted. Finally, in this regression model, the filter have been built the contour stencils. The numerical outcomes have been illustrated the proposed method was modest with the existing approaches while considering the visual effects and peak signal-to-noise (PSNR). Zhang and Li (2014) Recommended an innovative adaptive weighted mean filter (AWMF) by means to discover and eliminating the maximum level of salt-and-pepper noise. By increasing the window's size to the maximum, the adaptive window size have been found. The least value of two successive windows are the same. The experiments demonstrated the proposed filter has least error rate detection and maximum re-establishment quality mainly for maximum level of noise. Meher and Singhawat (2014) Proposed an upgraded recursive and adaptive median filter (RAMF) mainly for impulse noise which is corrupted by high density image restoration. By varying the working window size, the filter's adaptive operation have been verified those are positioned at noisy pixels. The work window size was changed according to the existence of the noise-free pixel. The results have been shown so many real-time noisy images that demonstrated the RAMF approach was overwhelmed than the existing filters. The filter's supremacy have been verified by the visual interpretation.

Kartik, et al. (2016) Framed an innovative method according to fuzzy logic. The salt and pepper noises are reduced by the method of centroid defuzzification. The various minute edges of the ruined images have been preserved. For 8-bit images of various noise percentage, the proposed approach have been verified and compared with the existing approaches. In terms of PSNR values, the proposed approach was provided reasonable outcomes and the different tiny edges have been preserved. The canny edge detector was used to evaluate the edges. Shukla, et al. (2014) Presented the approach by means to progress the directional order statistics filter performances to reduce the salt-and-pepper noise. There are nearly eight ways have been applied to recover the non-boundary and boundary pixels. The non- boundary pixels have been found as the noise free, this was left without any further process. If not, it has to process by directive statistic parameters belongs to the local window. The considered performance parameters are SSIM and PSNR for the evaluation of the restored image quality which was attained by the proposed method.Xu, et al. (2018) Developed an innovative two-stage approach to reduce the salt and pepper noise. The gray or color variation have been categorized among the pixels and the adjacent pixels at various scales. The order-inducing variables have been determined by the proposed approach. The detected noise candidate have been restored by the operators of weighted vectors of the induced generalized order weighted average (IGOWA). The experiment results have been demonstrated the gray and color images which was utilized to suppress the noise efficiently and the image information was maintained well when compared with the existing approaches.

Li, et al. (2014) Proposed the improved directional weighted filter to solve the problems after analyzing the affecting reasons. This was initially detected the salt and pepper noise through the combination of state-of-art- approach directional gray level variances along with the further results of the gray level extremes. The outcomes from the experiments in the image set have shown the proposed algorithm have been attained the important developments by mean to suppress the noise particularly in the high density noises.Liu, et al. (2015) Presented an innovative algorithm for suppress IN. An innovative statistical appliance ROD-ROAD and introduced a rule of fuzzy mainly to relate the pixel to be noisy. According to the outcomes, the edge pixels have been chosen from the noisy images by an innovative statistic MEPD that was used to develop the accuracy in detection. The proposed approach used a simple optimization approach which was easy to proceed the implementation. The outcomes shown overwhelmed performances in reducing the RVIN. Roy, et al. (2016) Proposed Fuzzy filter (FF) according to the Support vector machine (SVM) classification on the way to eliminate impulse noise from the gray scale images. During the phase of testing, Fuzzy filtering have been processed based on the decision attained. The simulation outcomes recommended the way of achieving the superior performance when comparing the existing approaches in case of conserving the similarity in the structural to the great level.

Ma and Nie (2018) Proposed an adaptive directional mean filter and noise removal detector according to the difference parameter characteristics. The one kind of pixels are renovated by using mean filter. The developed filter are restored other kind of pixels. The optimum filtering window was selected adaptively by the new filter. Then the gray level of noise corrupted pixels are replaced through the pixels mean value in the optimized pattern. The experiment outcomes have been shown the overwhelmed performance of the proposed filter with the existing filters while considering the suppression of noise and the information preservation.Malinski and Smolka (2016) Presented the innovative approach to remove the noise from impulsive in the color images. According to the concept of peer group, a new filter has been designed, which was used to govern the central pixel membership corresponds to the filtering window to its local neighborhood. This proposed filtering design was proven the effectiveness in the restoration.

(Lu, et al. 2017) elucidated a novel face recognition approach through fusing the shape and texture features. Initially, the SDM was used for extracting landmarks of the face. The texture information of the face was extracted using modified Google Net. Next these two features were fused and balanced together with the help of principal component analysis (PCA). Lastly, the face dataset was searched with the use of the fused features for acquiring the results. To increase the efficiency, a coarse-to-fine search mechanism was employed for finding the effective similar objects.

(Jian and Lam 2014) proposed an efficient method for retrieval of face image. For this process the singular values and potential-field representation was employed. Initially, the foremost singular values were utilized as rotation-shift-scale-invariant global feature and it was theoretically proved. For the feature extraction process the acquired properties of singular values were used to develop a compact global feature

for face-image representation. For the further enhancement of the retrieval performance, the singular values of the potential field was used which is derived from edge gradients. The GTAV database related an experimental result was analyzed and it was proved that the usage of singular values as rotation-shift-scale-invariant global features produced reasonable retrieval results.

Kumar, et al (Kumar, et al. 2013) surveyed the retrieval of 2D image with multiple dimensions and multimodality images from sources which including a diverse collection of medical data. An image search techniques found the images which was corresponding to given query. The similarity properties of visual components were used to identify the similarity of two images. Then these features were used to reduce the two limitations were, sensory gap and semantic gap. Euclidean distance was used to measure the features in terms of vector, distance metrics.

2. WAVELET BASED QUATERIAN MEDIAN FILTER

Quaterian is an algebra for generalizing the complex numbers and also four-dimensional non-commutative. Generally, a Quaterian q is denoted as

$$q = p + ai + bj + ck \quad (1)$$

Where p, a, b and c are the real numbers. The imaginary numbers of orthogonal such as i,j and k have to follow subsequent rules:

$$\begin{aligned} i^2 = j^2 = k^2 = -1; \\ ij = -ji = k; \\ ik = -ki = j; \\ jk = -kj = i \end{aligned} \quad (2)$$

The q's conjugate is: $q^* = p + ai + bj + ck$. The q's norm is: $\|q\| = \sqrt{(qq^*)}$. The Quaterian is denoted in so many methods. Initially, it can be mentioned as $q = D(q) + E(q)$ here $D(q) = p$, $E(q) = ai + bj + ck$. The Quaterian per unit pure is acquired once the condition is $\|q\| = 1$, and also the pure Quaterian is evaluated when $p = 0$. Next, it can also be mentioned in the form of polar: $q = \|q\| e^{i\phi} e^{j\theta} e^{k\psi}$. There are three angles, namely phase angles those are evaluated by the following approach:

$$\phi = \arctan\left(2(ba + pa), \left(p^2 - a^2 + b^2 - c^2\right)\right)/2 + k\pi \in [-\pi, \pi] \quad (3)$$

$$\theta = \arctan\left(2(ac + pb), \left(p^2 + a^2 - b^2 - c^2\right)\right)/2 \in [-\pi/2, \pi/2] \quad (4)$$

$$\psi = \arcsin\left(2(pc - ab)\right)/2 \in [-\pi/4, \pi/4] \quad (5)$$

A Quaterian Wavelet Transform (QWT) has three phase angles and one magnitude. The QWT delivers the better off analysis Scale-Space than the performance of the Complex Wavelet Transform or Wavelet Transform. Based on the theory of Bulow, the coefficients of QWT are nearby shift invariant. Alternatively, QWT is measured as a local Quaterian Fourier transform (QFT). Consequently, the sub-bands of QWT are the analytic signals of Quaterian , which comprehending the annoying symmetrical data. The Quaterian ic analytic signal along with a function of 2D is mentioned in the equation below:

$$f_q(a,b) = f(a,b) + iH_{i1} f(a,b) + jH_{i2}(a,b) + kH_i f(a,b) \quad (6)$$

Where H_{i1} and H_{i2} are the partial Hilbert Transform. Also, H_i denotes the cumulative Hilbert Transform and $f(a,b)$ mentions the real-valued 2-D signal.

Actually, the 2D Quaterian ic analytic filter is the mother wavelet which is easy to produce the analytic coefficients. It receives indigenous magnitude as well as the limited phase ideas in signal analysis from the analytic signals corresponds to 1D.

In case, an actual divisible function of scaling is $\phi(a,b)$ and $\psi^D(a,b)$, $\psi^V(a,b)$ and $\psi^H(a,b)$ are denoted each mother wavelets correspondingly. The Quaterian domain's analytic extension can be mentioned by the following equations,

$$\begin{aligned} \varphi(a,b) = \varphi_h(a)\varphi_h(b) \to \varphi(a,b) \\ + iH_{i1}\varphi(a,b) + jH_{i2}\varphi(a,b) + kH_i\phi(a,b) \end{aligned} \quad (7)$$

$$\begin{aligned} \psi^D(a,b) = \psi_h(a)\psi_h(b) \to \psi^D(a,b) \\ + iH_{i1}\psi^D(a,b) + jH_{i2}\psi^D(a,b) + kH_i\phi^D(a,b) \end{aligned} \quad (8)$$

$$\begin{aligned} \psi^V(a,b) = \varphi_h(a)\psi_h(b) \to \psi^V(a,b) \\ + iH_{i1}\psi^V(a,b) + jH_{i2}\psi^V(a,b) + kH_i\phi^V(a,b) \end{aligned} \quad (9)$$

$$\begin{aligned} \psi^H(a,b) = \psi_h(a)\varphi_h(b) \to \psi^H(a,b) \\ + iH_{i1}\psi^H(a,b) + jH_{i2}\psi^H(a,b) + kH_i\phi^H(a,b) \end{aligned} \quad (10)$$

From the real perception, when the mother wavelet is divisible, then the Transform of 2D Hilbert is same as to the rows and columns of the 1D Hilbert Transform. In case, there is a scaling function's pair of 1D Hilbert Transform is $\varphi_h, \phi_g = H\phi_h$ and a pair of wavelets in 1D Hilbert Transform is $\psi_h, \psi_g = H\psi_h$. In terms of separable products belongs to the 2D QWT can be denoted by the subsequent equations,

$$\begin{aligned} \varphi(a,b) = \varphi_h(a)\varphi_h(b) + \varphi(a,b) + i\varphi_g(a)\varphi_h(b) \\ + j\varphi_h(a)\varphi_g(b) + k\phi_g(a)\phi_g(b) \end{aligned} \quad (11)$$

$$\begin{aligned} \psi^D(a,b) = \psi_h(a)\psi_h(b) + i\psi_g(a)\psi_h(b) \\ + j\psi_h(a)\psi_g(b) + k\psi_g(a)\psi_g(b) \end{aligned} \quad (12)$$

$$\psi^{V}(a,b)=\varphi_h(a)\psi_h(b)+i\varphi_g(a)\psi_h(b)+j\varphi_h(a)\psi_g(b)+k\phi_g(a)\psi_g(b) \quad 13$$

$$\psi^{H}(a,b)=\psi_h(a)\varphi_h(b)+i\psi_g(a)\varphi_h(b)+j\psi_h(a)\varphi_g(b)+k\psi_g(a)\phi_g(b) \quad 14$$

The decomposition of the image is totally depends upon the location of the image regarding the axes of the a and b. The wavelet is not belongs to the property of the isotropic. The benefits of this wavelet is easy method of estimation along with the separable filter banks.

In this work, for design a wavelet based quaterian Median filter, the concept of quaterian wavelet transform is incorporated with the Median filter.

$$f_e(a,b)=g(a,b)\otimes h(a,b) \quad 15$$

The values of median of g in an already prescribed locality of $h(a,b)$ is utilized instead of using the value of $f_e(a,b)$. According to the equation 15, wavelet based quaterian Median filter is designed. This wavelet based quaterian Median filter is improved results than previous methods. In case of discovering the RVIN, EMF uses a three row and the three column also together of small diagonal 3X3 window mainly for evaluating the dual threshold. This technique is much better rather than other previous method

$$D=10\log_{10}\frac{\frac{1}{NO}\sum_{i=1}^{N}\sum_{j=1}^{O}e^{2}_{i,j}}{B} \quad 16$$

The filter's performance is estimated through the PSNR that is considered via utilizing the following equation,

$$PSNR=10\log_{10}\frac{(Q-1)^2}{\frac{1}{NO}\sum_{i=1}^{N}\sum_{j=1}^{O}e^{2}_{i,j}} \quad 17$$

Where, $e_{i,j}=y_{i,j}-r_{i,j}$.

Here Q is the level of grays which is normally 256 for digitized images. At the location (i,j) in the reference images(i=1,2,3…..,N; j=1,2,3….., O) the pixel luminance is mentioned as ri,j. Assume xi,j and Yi,j as the luminance of the pixel at the similar position in the input noisy image and also filtered one correspondingly.

FEATURE EXTRACTION:

Feature extraction is the process where the expressive information are extracted. The color features are extracted by the color histogram which is modest and common approach in the image retrieval techniques.

Color histogram:

Color histogram is utilized for the effective content representation and the color pattern is unique compared to other dataset. In order to characterize the global and local color, color histogram is effective and easy as well. A pixel number for the given color is calculated the extraction algorithm of color histogram that involves following stages.

- A color space gets segregated into cells.
- Each cell is associated to a histogram bin
- A number of image pixel is counted in each cell and in the corresponding histogram bin the counted pixels are stored.

Modified Gray level concurrence matrix

Modified Gray-level concurrence matrix (GLCM) is the technique utilized for evaluating the textures concerning the pixel spatial relationship. The pair of pixel occurrence is calculated here along with definite values as well as with definite image spatial relationship. For image texture analysis, GLCM is an effective method

At the distance d=1, the matrices are constructed and the direction is 0, 40, 90, 135. The texture information is extracted for each masses and non-masses tiles area using these directions. The GLCM texture descriptor are contrast, homogeneity, energy and correlation of gray level values. The GLCM dominant features on the basis of t test are ASM, sum entropy, sum variance and correlation. Thus the four features utilized in this experiment is given below

ASM demonstrates the image size with homogeneity properties or the size of each element occurrence matrix proximity

$$\text{ASM} = \sum i,j \frac{p(i,j)}{1+|i-j|} \quad (18)$$

Correlation is the term where the linear relationship size of the neighborhood pixel gray level is estimated

$$\text{Correlation} = \sum_{i,j}\frac{(i-\mu_i)(j-\mu_j)\,p(i,j)}{\sigma_i\ \sigma_j} \quad (19)$$

Sum entropy:

An uneven shape of an image size is shown in the entropy measure.

$$\text{Sum entropy} = \sum_{i=2}^{2NG} P_{x+y}(i)\log\{p_{x+y}(i)\} \quad (20)$$

Sum variance is the measure in which the high frequency of occurrence is measured with equal concentration over the lowest and highest cells of the concurrence matrix.

$$\text{Sum variance} = \sum_{i=2}^{2NG}(i-SumEntro)^2 p_{x+y} \quad (21)$$

Statistical features

A statistical features are defined as the correlation between the adjacent pixels. The features are extracted by computing the mean, median, standard deviation, and skewness, and kurtosis, coefficient of variation variance, covariance, correlation, and entropy. This computation gives the set of feature vectors for an image.

Structure for classification and machine learning approach:

In this approach, every patch has tensor of dimensions s*s* c_r. During classification task, the parameter c_r resembles the quantity of principal components where the 99.9% of initial information have been preserved while determining the number of each pixel neighbors with parameter s.

The parameter s should be equal to 5 during the experimental setup for considering the nearest 24 neighbors of each pixel. The number of neighbors considered here is increased by increasing the s value, hence the classification computational cost is increased as well. Even increase in the parameter of s does not make any sense for the improvement in the classification accuracy. Conversely, if s parameter increases beyond 13 worsens the accuracy in classification.

After estimating the parameters s and c_r , the design of CNN structure is proceeded. In this work, the convolutional layer is the first layer taken with C1=3* c_r and 3*3 trainable filters of dimensions. The C1 matrices of 3*3 dimensions are brought from this layer. The border of the patch is not considered while convolution occurs. As the translation and scale invariance are not considered, the max pooling layer is not utilized next to the convolutional layer which is one of the contradiction in conventional CNN. Because of this purpose, the first convolutional layer is succeeded by $C_2 = 3*C_1$ trainable filters of second convolutional layer. A 3*3 matrices filters are obtained once again.

A vector containing C_2 elements are obtained from the second convolutional layer and it is fed-up into MLP classifier. An input dimensionality is not smaller than the number of MLP concealed units. Specifically, the number of hidden units are specified as $6*C_r$. An optimal model parameters are learnt with the standard propagation algorithm that is employed here for training the deep learning architecture.

Thus the new structured CNN is utilized for classification approach to acquire an effective image retrieval process.

3. PERFORMANCE ANALYSIS

The proposed wavelet based Quarterian Median Filter performance is taken from the huge dataset such as Set12 dataset and BSD68. In this section, the some of the samples are shown with various ratio of noise. The Fig1. Shows the

Fig.1. Cameraman Input Image with 15% Noise vs Filtered Image

Fig.2. Cameraman Input Image with 25% Noise vs Filtered Image

Fig.3. Cameraman Input Image with 35% Noise vs Filtered Image

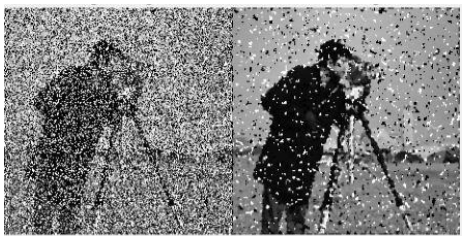

Fig.4. Cameraman Input Image with 50% Noise vs Filtered Image

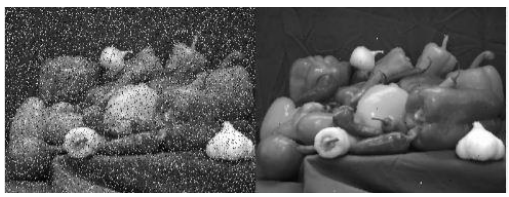

Fig.5. House Input Image with 15% Noise vs Filtered Image

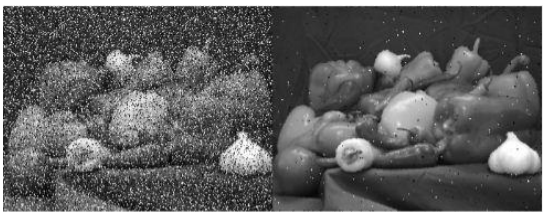

Fig.6. House Input Image with 25% Noise vs Filtered Image

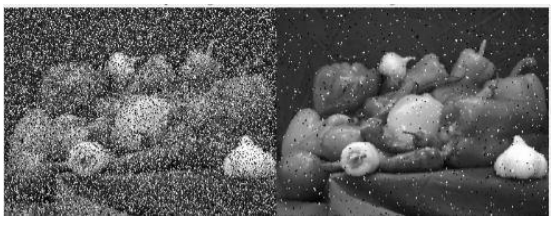

Fig.7. House Input Image with 35% Noise vs Filtered Image

The PSNR (DB) Results BM3D, WNNM, TNRD, DnCNN, FFDNet approaches on the Dataset of Set12 with the various Noise Levels starting from 15 to 75. The table 1 shows the results for the noise ratio of 15.

Table 1: For $\sigma = 15$ comparison with the Existing Approaches.

Images	BM3D	WNNM	TNRD	DnCNN	FFDNet	WBQMF
C-man	31.91	32.17	32.19	32.61	32.42	32.94
House	34.93	35.13	34.53	34.97	35.01	35.27
Peppers	32.69	32.99	33.04	33.30	33.10	33.20
Starfish	31.14	31.82	31.75	32.20	32.02	32.08
Monarch	31.85	32.71	32.56	33.09	32.77	33.10
Airplane	31.07	31.39	31.46	31.70	31.58	31.36
Parrot	31.37	31.62	31.63	31.83	31.77	31.85
Lena	34.26	34.27	34.24	34.62	34.63	34.64
Barbara	33.10	33.60	32.13	32.64	32.50	33.50
Boat	32.13	32.27	32.14	32.42	32.35	32.45
Man	31.92	32.11	32.23	32.46	32.40	32.51
Couple	32.10	32.17	32.11	32.47	32.45	32.49
Average	32.37	32.70	32.50	32.86	32.75	35.17

Table 1 illustrates the comparison of the existing approaches for Starfish, House, Airplane, Peppers, Lena, Monarch, Parrot, Barbara, Boat, C-man, Couple and Man. The average of the images are finally considered. These images are initially corrupted with the noise ratio of 15. These noise then reduced with the proposed WBQMF filter design. The proposed output is mention in the above table. It is clearly shows the proposed WBQMF is overwhelmed than other existing approaches for some of the input images. At last the image recovery capacity of the proposed approach is verified with taking the average values of the

Table 2: For $\sigma = 25$ comparison with the Existing Approaches.

Images	BM3D	WNNM	MLP	TNRD	DnCNN	FFDNet	WBQMF
C-man	29.45	29.64	29.61	29.72	30.18	30.06	30.07
House	32.85	33.22	32.56	32.53	33.06	33.27	33.29
Peppers	30.16	30.42	30.30	30.57	30.87	30.79	30.83
Starfish	28.56	29.03	28.82	29.02	29.41	29.33	29.46
Monarch	29.25	29.84	29.61	29.85	30.28	30.14	30.24
Airplane	28.42	28.69	28.82	28.88	29.13	29.05	29.18
Parrot	28.93	29.15	29.25	29.18	29.43	29.43	29.42
Lena	32.07	32.24	32.25	32.00	32.44	32.59	32.61
Barbara	30.71	31.24	29.54	29.41	30.00	29.98	31.25
Boat	29.90	30.03	29.97	29.91	30.21	30.23	30.26
Man	29.61	29.76	29.88	29.87	30.10	30.10	30.28
Couple	29.71	29.82	29.73	29.71	30.12	30.18	30.19
Average	29.97	30.26	30.03	30.06	30.43	30.43	30.59

Table 2 contains the comparison value of existing approaches for 13 images. These images are undergone the denoising process for the noise ratio of 25. The suppression of noises is carried by the proposed WBQMF filter design. It is clearly shows the proposed WBQMF is showed the improved performance than other existing approaches for some of the input images.

Table 3: For $\sigma = 35$ comparison with the Existing Approaches.

Images	BM3D	WNNM	MLP	DnCNN	FFDNet	WBQMF
C-man	27.92	28.08	28.08	28.61	28.54	28.64
House	31.36	31.92	31.18	31.61	31.99	31.95
Peppers	28.51	28.75	28.54	29.14	29.18	29.16
Starfish	26.86	27.27	27.12	27.53	27.58	27.59
Monarch	27.58	28.13	27.97	28.51	28.54	28.56
Airplane	26.83	27.10	27.22	27.52	27.47	27.50
Parrot	27.40	27.69	27.72	27.94	28.02	28.05
Lena	30.56	30.73	30.82	30.91	31.20	31.40
Barbara	28.98	29.48	27.62	28.09	28.29	28.31
Boat	28.43	28.54	28.53	28.72	28.82	28.83
Man	28.22	28.33	28.47	28.66	28.70	28.73
Couple	28.15	28.24	28.24	28.52	28.68	28.65
Average	28.40	28.69	28.46	28.82	28.92	28.94

Table 3 denotes the comparison of the existing approaches around 13 images. These kind of images initially undertaken for the noise ratio of 35. The suppression of noises is carried by the proposed WBQMF filter design. It is clearly shows the proposed WBQMF is showed the enhanced performance than other existing approaches for some of the input images.

Table 4: For $\sigma = 50$ comparison with the Existing Approaches.

Images	BM3D	WNNM	MLP	TNRD	DnCNN	FFDNet	WBQMF
C-man	26.13	26.45	26.37	26.62	27.03	27.03	27.06
House	29.69	30.33	29.64	29.48	30.00	30.43	30.42
Peppers	26.68	26.95	26.68	27.10	27.32	27.43	27.45
Starfish	25.04	25.44	25.43	25.42	25.70	25.77	25.78
Monarch	25.82	26.32	26.26	26.31	26.78	26.88	26.91
Airplane	25.10	25.42	25.56	25.59	25.87	25.90	26.00
Parrot	25.90	26.14	26.12	26.16	26.48	26.58	26.62
Lena	29.05	29.25	29.32	28.93	29.39	29.68	29.73
Barbara	27.22	27.79	25.24	25.70	26.22	26.48	26.49
Boat	26.78	26.97	27.03	26.94	27.20	27.32	27.36
Man	26.81	26.94	27.06	26.98	27.24	27.30	27.33
Couple	26.46	26.64	26.67	26.50	26.90	27.07	27.09
Average	26.72	27.05	26.78	26.81	27.18	27.32	27.35

Table 4 illustrates the comparison of the existing approaches for around 13 images. These images are initially corrupted with the noise ratio of 50. These noise then reduced with the proposed WBQMF filter design. The proposed output is mention in the above table. It is clearly shows the proposed WBQMF is overwhelmed than other existing approaches for some of the input images.

Table 5: For $\sigma = 75$ comparison with the Existing Approaches

Images	BM3D	WNNM	MLP	DnCNN	FFDNet	WBQMF
C-man	24.32	24.60	4.63	25.07	25.29	25.30
House	27.51	28.24	27.78	27.85	28.43	28.42
Peppers	24.73	24.96	24.88	25.17	25.39	25.41
Starfish	23.27	23.49	23.57	23.64	23.82	23.87
Monarch	23.91	24.31	24.40	24.71	24.99	25.64
Airplane	23.48	23.74	23.87	24.03	24.18	25.03
Parrot	24.18	24.43	24.55	24.71	24.94	25.13
Lena	27.25	27.54	27.68	27.54	27.97	28.14
Barbara	25.12	25.81	23.39	23.63	24.24	24.98
Boat	25.12	25.29	25.44	25.47	25.64	25.49
Man	25.32	25.42	25.59	25.64	25.75	25.82
Couple	24.70	24.86	25.02	24.97	25.29	25.99
Average	24.91	25.23	25.07	25.20	25.49	25.76

Table 5 illustrates the comparison of the existing approaches for 13 images. These images are initially corrupted with the noise ratio of 75. Initially, image acquisition is proceeded to reduce salt and pepper noise, the proposed WBQMF filter design is utilized. The proposed output is mention in the above table. It is clearly shows the proposed WBQMF is overwhelmed than other existing approaches for some of the input images. By observing the average value, the WBQMF is showing better results than the approach of BM3D approach. But the other approaches are shows the improved performance than the WBQMF approach**.**

THE AVERAGE PSNR (DB) OUTCOMES OF VARIOUS METHODS ON BSD68 WITH NOISE LEVELS FROM 15 TO 75:

Table 6: For Noise Levels 15, 25 35, 50 and 75 the comparison with Existing Approaches

Methods	σ = 15	σ = 25	σ = 35	σ = 50	σ = 75
BM3D	31.07	28.57	27.08	25.62	24.21
WNNM	31.37	28.83	27.30	25.87	24.40
MLP	___	28.96	27.50	26.03	24.59
TNRD	31.42	28.92	___	25.97	___
DnCNN	31.72	29.23	27.69	26.23	24.64
FFDNet	31.63	29.19	27.73	27.73	24.79
Modified Median	31.76	29.52	27.86	28.03	25.32

Corel-1 K dataset is utilized in this experimental approach. Corel-1 K collected 1000 images with ten classes and each class includes 100 images. To plot the consequences, in database each picture is used as query picture. The shortest distance d1 pictures are accumulated in this framework for each for each query picture. IN that picture, some of the pictures are important outcomes and the some are non-important outcomes that does not match the given query picture. User concerned pictures are named as relevant images and whole pictures recovered for a specified query are named as retrieved images. An image retrieval performance is calculated in terms of precision which is the ratio of relevant images to retrieved images.

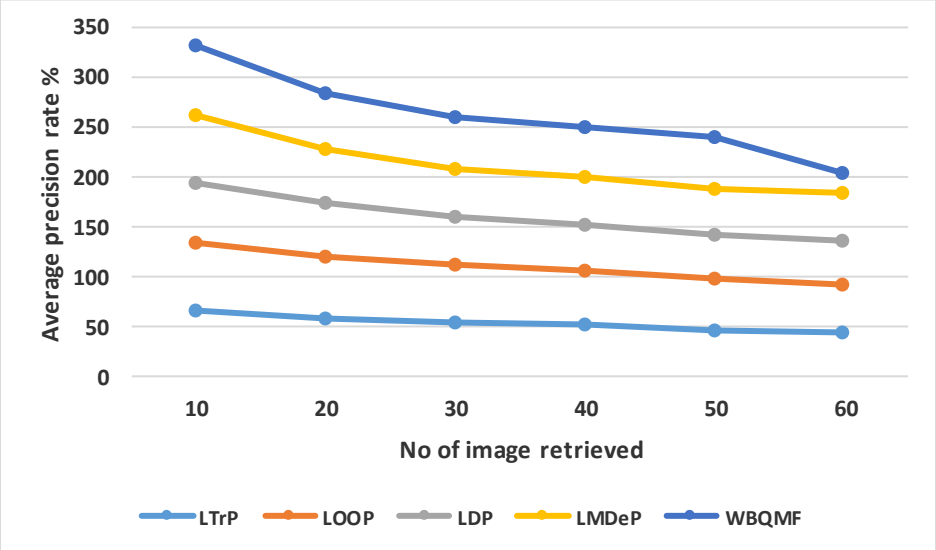

Fig 8: Experimental results of Corel 1K in terms of APR without noise (σ = 25)

Fig 9: Results of Corel 1K image retrieval

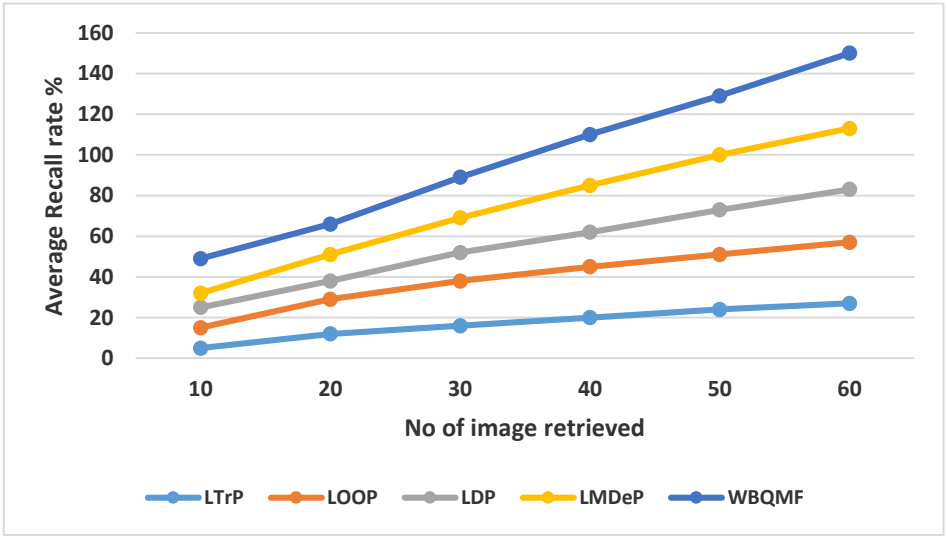

Fig 10: Experimental results of Corel 1K in terms of ARR without noise ($\sigma = 25$)

Table 7 illustrates the Average precision rate of existing LTrP, LOOP, LDP, LMDeP and WBQMF . At the image retrieval rate of 10, the existing approach acquires lesser APR than the proposed approach. A WBQMF yields higher precision rate for image retrieval of 10,20,30,40,50 and 60. The WBQMF offers better APR rate than other existing approaches. Figure 9 shows that the proposed method acquires better precision than conventional methods.

Table 7: Experimental results of Corel 1K in terms of APR without noise

Average Precision Rate					
No of image retrieved	LTrP	LOOP	LDP	LMDeP	WBQMF
10	66	69	59	69	70
20	59	62	54	54	56
30	54	58	48	49	52
40	53	54	46	47	50
50	47	52	44	46	52
60	45	48	43	49	50

Table 8 illustrates the Average Recall rate of existing LTrP, LOOP, LDP, LMDeP and WBQMF . At the image retrieval rate of 10, the existing approach acquires lesser ARR than the proposed approach. A WBQMF yields higher Recall rate for image retrieval of 10,20,30,40,50 and 60. The WBQMF offers better APR rate than other existing approaches. Figure 10 shows that the proposed method acquires better precision than conventional methods.

Table 8: Experimental results of Corel 1K in terms of ARR without noise

Average Recall Rate					
No of image retrieved	LTrP	LOOP	LDP	LMDeP	WBQMF
10	5	10	10	7	17
20	12	17	9	13	15
30	16	22	14	17	20
40	20	25	17	23	25
50	24	27	22	27	29
60	27	30	26	30	37

Corel 5k Dataset

Corel-5K contains 5,000 images that decrease in 50 categories, such as beach, bird, jewelry, sunset, etc., each covering 100 images. A leave-one-out method is utilized to query all 5,000 images, i.e., querying each image with the residual 4,999 images by means of the database images. The performance is assessed through r-precision, i.e., the precision for the top r candidates, averaged over the 5,000 queries

Table 9: Experimental results of Corel 5K in terms of APR without noise

Average Precision Rate					
No of image retrieved	LTrP	LOOP	LDP	LMDeP	WBQMF
10	44	43	37	46	56
20	34	35	29.5	37	67
30	29	31	25.2	33	47
40	27	28	23	26	59
50	25	26	21	25	54
60	23	24	19	24	54

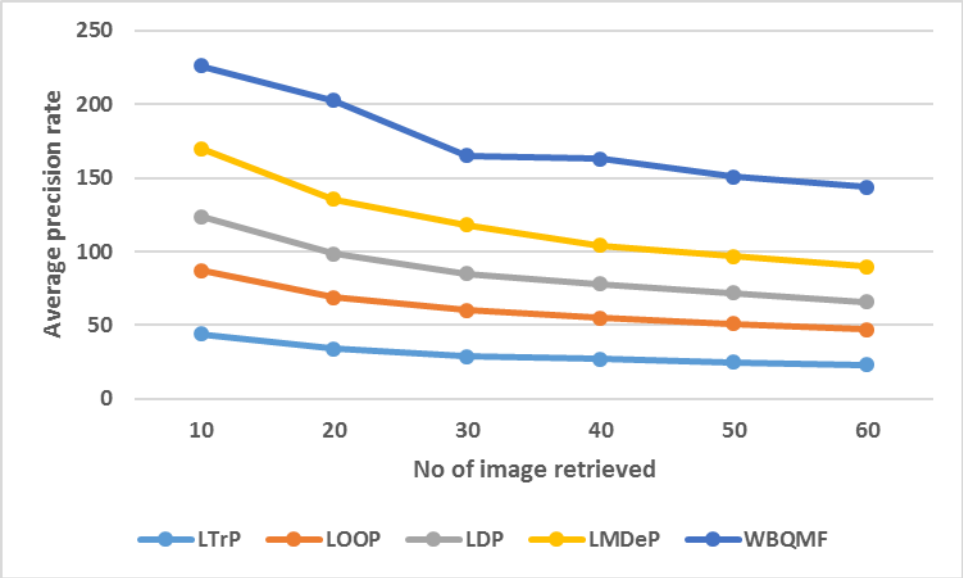

Fig 11: Experimental results of Corel 5K in terms of APR without noise (σ = 25)

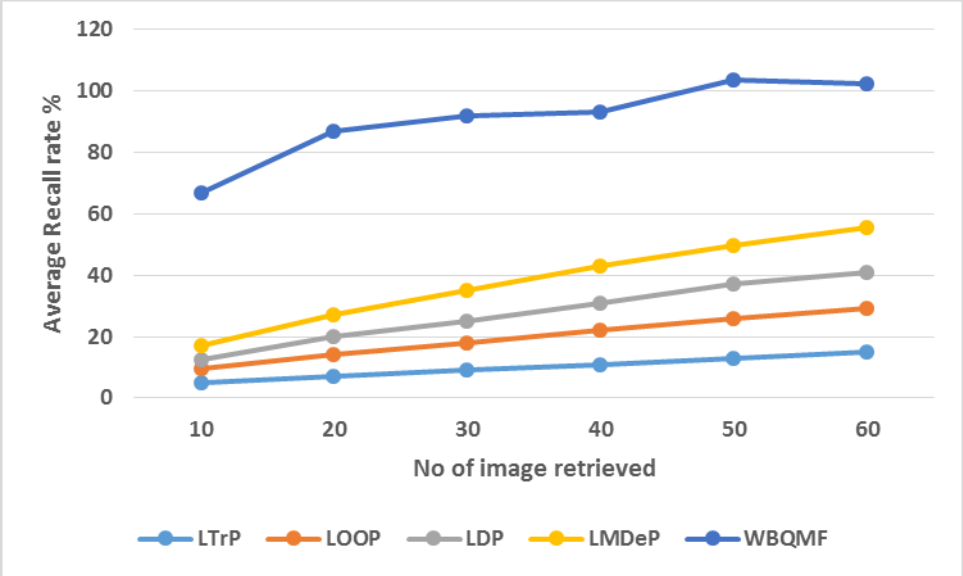

Fig 12: Experimental results of Corel 5K in terms of ARR without noise (σ = 25)

Table 9 illustrates the Average Recall rate of existing LTrP, LOOP, LDP, LMDeP and WBQMF . At the image retrieval rate of 10, the existing approach acquires lesser APR than the proposed approach. A WBQMF yields higher Precision rate for image retrieval of 10,20,30,40,50 and 60. The WBQMF offers better APR rate than other existing approaches. Figure 11 shows that the proposed method acquires better precision than conventional methods.

Table 10: Experimental results of Corel 5K in terms of ARR without noise

Average Precision Rate					
No of image retrieved	LTrP	LOOP	LDP	LMDeP	WBQMF
10	5	4.5	3	4.5	50
20	7	7	6	7	60
30	9	9	7	10	57
40	11	11	9	12	50
50	13	13	11	12.5	54
60	15	14	12	14.5	47

Table 10 illustrates the Average Recall rate of existing LTrP, LOOP, LDP, LMDeP and WBQMF. At the image retrieval rate of 10, the existing approach acquires lesser ARR than the proposed approach. A WBQMF yields higher Recall rate for image retrieval of 10,20,30,40,50 and 60. The WBQMF offers better ARR rate than other existing approaches. Figure 12 shows that the proposed method acquires better recall rate than conventional methods.

Fig 13: Results of Corel 5k

4. CONCLUSION

In this proposed work, the experiments is carried to suppress the Random Valued Impulse Noise (RVIN) and salt and Pepper Noise (SPN) and in the high level of noise density images. And also feature extraction is the carried out using an effective feature extraction approaches such as color histogram, GLCM and statistical features for dimensionality reduction. The work proposes an innovative work Wavelet Based Quaterian Median Filter (WBQMF) in which the retrieval of image is achieved better than other conventional approaches. Finally, the WBQMF is associated with the existing approaches. For comparison, the BM3D, WNNM, TNRD, DnCNN, FFDNet Methods on Set12 Dataset with various Noise Levels is considered. For comparison, LTrp. LOOP. LDP and LMDeP methods on corel 1K and Corel 5K with APR and ARR measures is considered. This developed WBQMF shows the improved results in terms of Peak Signal to Noise Ratio (PSNR) in various kind of images, APR and ARR rate. There is also a scope for the future research that this WBQMF filter can also be carried with the huge level of datasets.

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