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Elimination Noise from Image Using Machine Learning Techniques

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***Abstract:** The Image Processing system is mostly used because of their easy accessibility of powerful personal computers, bulk memory machines with graphics software and others visual application. Of "Image Processing" is applied in a number of applications. These include in area of Remote Sensing in GIS application, Medical Imaging Processing for patient care application, Forensic Studies, Textiles engineering and design, Material science, Military Research, Film industry application, and Document processing, Graphic arts. An image is defined as an array, or a matrix, square pixel arranged in rows and columns. Many image-processing procedures involve making the image as a two-dimensional signal and applying standard signal processing techniques to it. Image processing can be defined by means of a digital image processing . The pitch of digital image processing states to processing digital images through channels of a computer. In this paper Image de-noising through K-SVD algorithm is presented by taking the RGB color with 256*256 sizes 24 bit standardize image.*

***Keywords:** CAFSM (Cluster Based Adaptive Fuzzy Switching Median, HAF (Histogram Adaptive Fuzzy), Fuzzy C-means, SVD (Singular Value Decomposition), MDB (Minimum-maximum Detector Based), AFMF (Adaptive Fuzzy Mean).*

1. INTRODUCTION

The area in digital image processing is ways to processing digital images by channels of a computer. It involves many approaches that are Image Segmentation, Image Recognition, Image Restoration processing, 'Differencing and Morphing, Digital Compositing, Color Corrections and others work of image. However the above mentioned applications that include digital image processing are now being used to solve many problems. Eradication of noise is unique of the main works to be done in computer vision and image processing, by way of noise leads to the error in the image. Existence of noise is manifested by undesirable information, which is not at all related to the image under study, but in turn disturbs the

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information present in the image. It is translated into values, which are getting added or subtracted to the true gray level values on a gray level pixel. These unwanted noise information can be introduced because of so many reasons like: acquisition process due to cameras quality and restoration, acquisition condition, such as illumination level, calibration and positioning or it can be a function of the scene environment. Image de-noising process is carry out formed on the Singular Value Decomposition SVD algorithm for the effective removal of noises in the images. Primarily generated random noise is added to the images. Then phrasebook is fashioned for the in order to identify the noise place in the images. The clustering process sets of the noise placed in the images established on the difference noise in the images. Optimization method of images is based on the Low Rank optimization process. Finally, assumed structured sparse representation is working for the images to reconstruct of the high-resolution images. The performance of the development is measured with the help of operation metric like PSNR, FSIM.

Literature Review

Image de-noising or restoration became a research topic for past twenty years. In this work a lot of literature were referred and studied. Reginald L. Lagendijk, et al [1], have conferred that the Image Restoration using de-blurring or image de-convolution. The have estimated uncorrupt image from blurred and noise. As result the operation of inverse imperfections image formation they assumed noise is prior of noisy. Anamika Mourya, *et al* [2], have given weightage on classification of image techniques base on two type method i.e. image restoration and de-noising. As per research report image restorations have employed on deterministic method and stochastic method. The prior of knowledge of degradation applied on deterministic as linear method applied on stochastic method. Charu Khare, *et al* [3], have focus on image restoration by using different filtering methods. Their experiment perform base on careful examined the several filter i.e. Histogram Adaptive Fuzzy (HAF), Weighted Fuzzy Mean (WFM), Minimum-maximum Detector Base (MDB),Adaptive Fuzzy Mean(AFMF), Centre Weighted Mean(CWM) and Min-Max Exclusive Means(MMEM) filter. Jianjun Zhang, *et al* [4], research work shown removing impulse noise from corrupted image by use variety of applications of Median Pass filter. All pixel of image equality can analyze by conventional Median Pass filter. As result they find that elimination of fine details such as thin line corner blurring in the image. It is overcome the problem of various type filters. S Jayaraman, et al [5], have present that suppress of salt paper noise by use many type nonlinear filter. So the median line filter has development on the thin line edge and sharpness from input image. The variant median filters are i.e. a center-weighted median filter, weighted median filter, max median filter. The three RGB color plane on image applied on median filter. So result is that median filter capability to suppress image. Kenny Kal Vin, *et al* [6], analyzed filtering impulse noise of CAFSM (Cluster Based Adaptive Fuzzy Switching Median) is more effective. As per there research median filter is more weighted to central value of each window suppressing white or impulse noise on 512×512 size image with 5% to 50% noise density. It can also work on gray scale image with 5% to 50% noise on fixed size window. Mitsuhiko Meguro, *et al* [7], have proposed suppressing both impulsive and no impulsive noise may preserving detail. The weight of Adaptive Weight Median (AWM) depends on the three characteristics. a) AWM filter found more performance. b) The weight

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of AWM filter is derived by fuzzy technique call Fuzzy Weigh Median (FWM) filters. c) AWM filter based on statistic for restore image effectively. Changn Shing Lee, *et al* [8] have discussed dynamic selection procedure determine the final out for each filtered pixel in color image restoration removing additive impulse noise. The performance improves WFM with light additive noise by use of fuzzy detector. Fuzzy detector can detect amplitude of impulse noise. The high quality restoration filter is based on Median Adaptive filter. Haixiang Xu, *et al* [9], In Adaptive Fuzzy Switching filter contains with fuzzy logic in image enhancement of image concept by impulse noise has cascade three subunit i.e. a) Detecting impulse noise. b) Implement gray scale, c) Suitable modified value of correction in order to improving filter. S.Muthukumar, *et al* [10], says that on image restoration they used the Improve Fuzzy Base Decision Algorithms (IFBDA) have applied highly corrupt paper salt nose. The IFBDA have better performance by use of Peak-Signal to Noise Ratio (PSNR), Structural Similarity index of Image Enhance Factor (IEF) and image quality value. Jaine, et *al [11]*, has described that an edge in an image is an important local change in the image strength. The change associated with discontinuity in either image strength a) where abruptly changes one in on side of the discontinuity to a different value on the opposite site. b) Where the image strength abruptly change value but then return to the starting value within so sort of distance. Michel Aharon,.et al[12], have analyzed that selected one from pre specified se of linear transformations better and fit to adoption the dictionary to set of training signal. In this paper they suggest a novel algorithm for adapting dictionaries in direction to achieve sparse signal images.

K-SVD Process

K-SVD method is a simplification of the k-means grouping method, and it works by iteratively alternating between the input data based on the current lexicon and sparse coding, and bring up-to-date the atoms in the lexicon to fit the data better. Low-Rank Optimization computed lexicon based on K-SVD process is then boosted resulting in the patch grouping process. The optimization method is working on Low rank estimate process. The low rank estimate process minimizes the overall errors in the obtained de-noised image.

$$\hat{X} = arg\, min_x \|DSX - T\|^2 + \lambda_{rank} Rank(X) + \lambda_{tv} TV \qquad \text{Eq..1}$$

Patch grouping process is employed based on measurement of similarity identification based grouping of the patches established on Fuzzy C means . Fuzzy C means process identifies the pixels that were similar and groups them into a single cluster. In the back propagation process, the noises in the images transpiring due to the pixel class based on the low rank approximation are removed. Performance of the enhancement process is measured based on the PSNR and FSIM calculation. The calculated performance metrics is shows that the proposed method and more efficient compared to the existing methods.

Fuzzy C-means algorithms alternately called soft clustering algorithms. Fuzzy C-means is grouping intra-class fashionable to weighted distance . We contemplate V is the set of cluster center i.e. V= $\{v_{0}, v_{1}, v_{2} \ldots\ldots\ldots\ldots v_{c-1}\}$ then optimum cluster might be

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$$j_m(U,V;\Phi) = \sum_{k=0}^{n-1}\sum_{c=0}^{c-1} u_{ik}^m \,||f_k - v_i||_A^2 \quad \text{Eq.2}$$

Suppose A is any positive define matrix of size n×n where n is number element x optimal clustering U*Φ is occupied from pain (U*, V*) that correspond to native of $J_{m.}$ Approximate optimization of J_m by fuzzy c-means calculation base on equation

If $D_{ikA}=||f_k-v_i||_A>0$ for all I and k then *(U,V)* may minimize J_m

$$u_{ik} = \left[\sum_{j=0}^{c-1}\left(\frac{D_{ikA}}{D_{jkA}}\right)^{2/(m-1)}\right]^{-1} \quad \text{Eq.3}$$

Aimed at 0≤i ≤c-1 and 0≤k≤n-1

$$v_i = \frac{\sum_{k=0}^{n-1}(u_{ik})^m f_k}{\sum_{k=0}^{n-1}(u_{ik})^m} \quad \text{Eq.4}$$

Techniques

There are basically two noises measured such as Gaussian noise and Impulse noise . Several noise compactness like low (0.4), medium (0.6), and has been implemented. Likewise the Gaussian noise with variance 0.01 and has been calculated using normalize color image of size 256×256 and of with bit 24 bit is taken to sensitivity. Filter used for de-noising the image for corrupted with Impulse noise . The performance can be evaluated through the simple PSNR and FSIM matrices . The class of de-noised image can be computed by the highest peak signal noise ratio.

$$PSNR = 10log_{10}\frac{MAX^2}{MSE} \quad \text{Eq.5}$$

As projected algorithm has capability to decrease the high density of the noise.

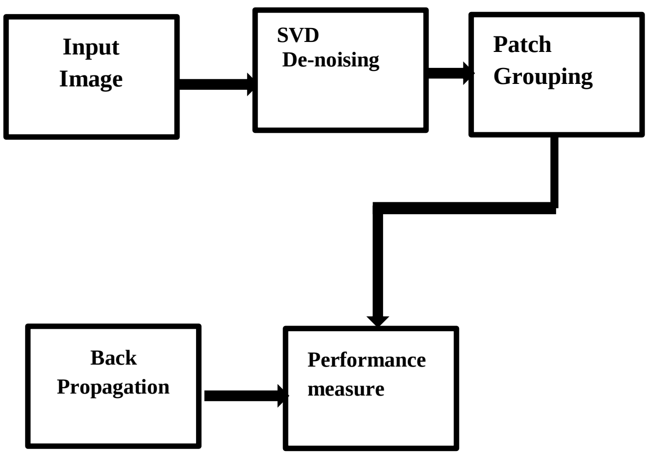

Fig.1 Block diagram of K-SVD de-noising process

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Algorithm

i) SVD Algorithms

SVD matrix is method that generalized the factorization eigen corrosion of a four-sided matrix (m×n) to any one matrix (n×m)

M- UEV^t where

Decompose left singular matrix i.e. Colum's are left singular vectors of Matrix MM^t of original matrix M

Submissions (Σ) diagonal matrix i.e. containing singular eigen values.

We consider V is right singular matrix and its columns of right singular vectors. Here V columns contain eigen vectors of M^{t}M matrix.

$$M = U \sum V^t \qquad \text{Eq.6}$$

ii) Fuzzy C Means Process Algorithms

Step1. Select first cluster center arbitrarily. The first *C* distinct mark vectors are taking initial group midpoints

$$V_i^{(0)} = f_i \;\; \dots, \dots, \dots \dots, \dots i = 0,1, \dots, \dots., c-1 \qquad \text{Eq.7}$$

Fixed t=1 and select the matrix A. Euclidean space A is uniqueness of matrix. Select similarly T is the maximum digit of repetitions allowed.

Step 2 Using Eq.3compute $u_{ik}^{(t)}$ from $V^{(t-1)}$

Step 3 Using Eq.4 computes u_{ik}^{t}

Step.4 Compute mistake at tth repetition as

$$E_t = \frac{max}{t}\left\{||v_i^{(t)} - v_i^{(t-1)}||_A\right\}$$

Step.5 if $E_{T>}$t, a predefined error threshold and t<T_i then
Increment t and go to Step2
Else Stop with $U^*=U^{(t)}$ and $V^*=V^{(t)'}$

2. EXPERIMENT AND RESULT

We consider RGB butterfly (.tie) picture image of size 256×256 of size with 24 bit has been taken in to consideration for K-SVD de-noising process. Here Additive Gaussian Noise added to the image.

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Fig.2 Input Image

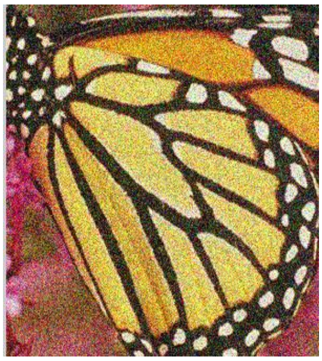
Fig.3 Noisy image (16.2341dB)

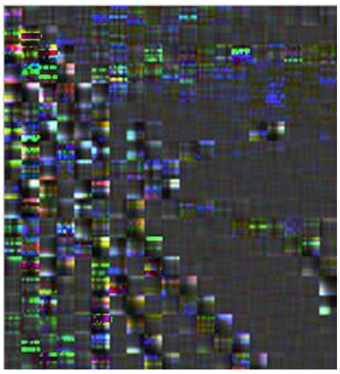
Fig.4 Initial dictionary

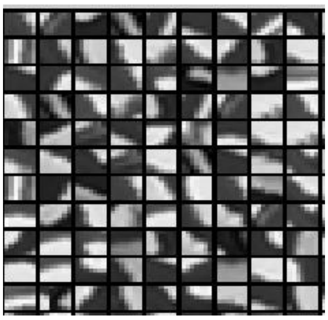
Fig.5 SVD dictionary formation

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Fig.6 De-noised Image (34. 5114dB)

K-SVD de-noising	Noisy Image PSNR Value	De-noised Image PSNR value	FSIM value
	16.234dB	34.1514	0.8

Table No. 1 .K-SVD de-noising using Additive Weighted Gaussian Noise noise of Standard deviation 40

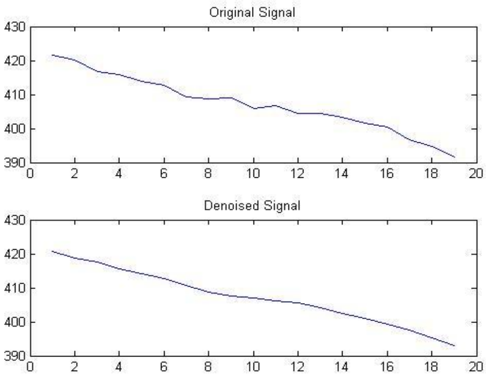

Fig.7 Compare of original Signal De-noised Signal of Image

Fig.8 Input Image

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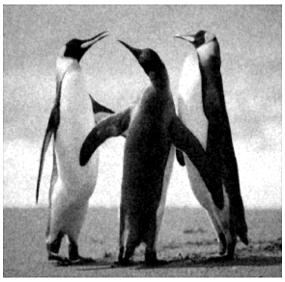
Fig.9 Noisy Image (17.253dB)


Fig.10 Noisy Grayimage (17.253dB)


Adaptive Median Filter(18.2039dB)


K-SVD De-noising((22.9558dB)

	Noisy Image PSNR Value	**De-noised Image PSNR value**	**FSIM value**
Adaptive Median filter (PSNR in dB**)**	17.253dB	18.2039dB	03
K-SVD de-noising process(PSNR in dB**)**	17.253dB	22.9558dB	0.8

Table No. 2 Comparative value of K-SVD de-noising Adaptive Median filter

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3. CONCLUSION

Now a day's Image De-nosing is an issue in image Processing and computer vision. There are various method involves in image de-noising, basically non-linear filters are used for elimination of noise and reconstruct the images. In this experimentation we persistent on the image de-noising concluded Non-Linear 'filters which is reduced the difficulty some to extend. The Non-Linear filter does not effective for entirely the noises and not penetrable to restore the original properties. In this work Image de-noising concluded on K-SVD algorithm is presented done by taking the RGB color with 256×256 sizes with 24 bit the normalize image. The operation matrices PSNR and FSIM have been measure. The K-SVD procedure reduces the difficulty and also includes the optimization method. The K-SVD algorithm provides also better result for RGB images. The K-SVD process is more suitable for all type of noisy images. The performance matrix proves that the proposed K-SVD de-noising process is more efficient for the de-noising images. At noise Impulse the K-SVD algorithm has better PSNR value and FSIM value than other de-noising process. For Gaussian noise of variance (0.05) the K-SVD algorithm has better PSNR and FSIM value.

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