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IMAGE RESTORATION USING LOW-RANK MATRIX RECOVERY & NEURAL NETWORK WITH MEDIA FILTER

Pawan Deep Kour[1], Er. Navjot Kaur Pannu(Assistant professor ECE) [2]

Electronics and Communication Engineering,
Panchkula Engineering college Mouli,Barwala.

Abstract — *Wireless Sensor Networks can accumulate decisive and precise information in inaccessible and precarious environments, and can be utilized in Military Affairs, National Defence, Environmental Monitor, Industrial Control, Traffic Management, Smart Home, Medical Care, and many more. The sensors whose resources are inadequate are inexpensive, and rely upon the battery for supplying electricity, so it is very important for routing to conveniently make use of its power. Earlier, for wireless sensor networks an energy-efficient SHAC (Single-Hop Active Clustering) approach was proposed. This algorithm has mainly three parts. First, a timer mechanism was introduced to choose tentative cluster-heads. Second, a cost function was proposed for balancing efficiently energy of each node. Lastly, active clustering algorithm was proposed. During both numerical results and theoretical analysis, it is depicted that with such algorithm the lifetime of the network can be increased considerably compared to the other clustering protocols namely LEACH-C and EECS. Single Hop Active Clustering may extend the lifespan of the network by up to 50 percent as compared to EECS.*

Keywords-*SHAC,EECS,RGB,LRMR.*

I. "INTRODUCTION"

An array or a matrix of square pixels i.e. components of image that square measure organized in columns and rows square measure called image. As human being have precise visual skill: we can identify a face in quick look; we can differentiate the colours; we can process a large amount of visual information very quickly. An image or a frame is a single picture which represents some information. It is 2 D representation of the pixels. In binary images, each pixel can have just one colour either black or white. Since, there are only two possible values for each pixel. It is very easy to secure binary image as there is just one bit per pixel. The binary representations of images are suitable for text, architectural and fingerprint purpose. In greyscale images each pixel is represented by 8 bits. It means a pixel can have 256 shades between black (0) and white (255). The representation of greyscale image is shown in figure. In greyscale image, each pixel is a single sample, which means each pixel reflects only intensity information. The colours contained in greyscale image are only shades of gray (between white and black). Each constituent of 8-bit gray scale image has Associate in Nursing alloted intensity whose vary is from zero to 255. A black and white image is additionally called a gray scale image. A common image has eight bit colour drop i.e. 256 gray scales. As an example: sixteen bit = 65536 gray scales.

RGB images can be defined with the help of RGB colour model. It is conjointly known as an additive colour model which suggests the 3 colors red, green and blue are superimposed in varied proportions as results of that an outsized array of colors reproduces. The name of RGB image obtains from the initials of Red, Green and Blue severally. RGB are the three primary colors. In RGB image, each pixel is composed of three colors i.e. red, green and blue. Every colour is represented by 8 bits, which means that in RGB image, one pixel has 24 bits. So that is why RGB images sometimes also known as 24 bit colour images. Therefore the range of the colors represented by the primary colors is 255^3= 1, 66, 77, 216. CMY is the subset of RGB and both form the most basic and well known colour model. This model bears closest resemblance to how we perceive colour. The RGB model describes a colour by assigning the intensity level of red, green and blue light that are mixed together to develop a pixel on the display.

Image process is employed in varied applications such as:

- Remote Sensing
- Medical Imaging
- Non-disastrous analysis
- Rhetorical Studies
- Fabric
- Material Science
- Military
- Industry
- Document process
- Graphic arts

- Printing trade

There square measure 2 approaches offered in Image process:
a) Analog Image Processing
Transformation of image through electrical means is known as analog image processing. The most common example is the television image.
b) Digital Image Processing
In this case, to process the image, digital computers are used. The term digital image method typically refers to method of a two-dimensional image by a pc.

II. LITERATURE REVIEW

This section described the analysis work that has been completed in recent years. Image compression is the ultimate favourable field of research within which assemble the interest of all analysts. A literature review goes on the far side inquiry of report or information and it co-relates the identification and affiliation of relationships among the literature and research field.
Zhang *et al.* planned a new HSI restoration method based on low-rank matrix recovery (LRMR) [14] which can simultaneously remove the Gaussian noise [15], impulse noise [16], dead pixels or lines [17] and stripes. Hyper spectral images (HSIs)can be disgraced by a mixture of different kinds of noise in the acquisition process which involve Gaussian noise, impulse noise, dead pixels or lines, stripes, and so on. Then to further remove the mixed noise, the "Go Decomposition" algorithm was implemented to solve the LRMR problem. The proposed method was an efficient method for HSI restoration.
Liu *et al.* proposed a 3-D tensor diffusion matrix based kernel regression HSI denoising method [18]. Kernel regression has been shown to be a powerful image denoising technique. After analyzing the geometric feature of eigenvectors [19] of 3-D tensor matrix, the diffusion coefficients were changed with its eigen values in order to be adaptive for each pixel. Then an adaptive-driven 3-D tensor matrix was applied to kernel regression denoising schema, in which the correlation among different bands was taken into consideration. The proposed method outperforms better in detail preservation and noise removal.
Sakai *et al.* proposed a Single-image super resolution (SR) reconstruction mistreatment the low-rank matrix recovery [20] and nonlinear mappings [21]. First, the low-rank matrix recovery was used to find out the underlying structures of subspaces spanned by the classified patch options. Second, the low-rank elements of low-resolution (LR) and high-resolution (HR) patch attributes square measure mapped onto high dimensional areas by nonlinear mappings severally. Then the mapped high-dimensional vectors square measure projected onto a unified area, wherever the 2 manifolds created by LR and hour patches severally have similar native pure mathematics and also the SR reconstruction was performed via neighbouring embedding. The planned methodology outperforms SR algorithms qualitatively and quantitatively.
Zhou *et al*. proposed a Bilateral random projection (BRP) [22] based mostly low-rank approximation is planned with high speed and higher error bounds. "Go Decomposition" (Go Dec) to approximate the low-rank half L and also the thin half S [23] of a general matrix X=L+S+G is evolved, wherever G was noise. Go Dec was considerably accelerated by mistreatment BRP based mostly approximation. The proposed algorithm discovered the robustness of GoDec.
The author proposed neural network based mostly multi scale technique [24] for restoring degraded pictures supported a universal coaching knowledge strategy for image restoration. The projected approach was optimistic and utilized in restoration processes with the profit that it doesn't would like a priori information of the degradation causes.
Licciardi*et al.* proposed a technique to solve the unfixing downside in hyper spectral information that supports NNs [25] for the extraction of constituent abundances from hyper spectral information. The NN do each the spatial property minimizing procedure and also the final unfixing. The authors introduced a technique in order to get rid of the staff-lines from the musical pictures. At first, objects possess height larger than a specific threshold unit of measurement being removed. This threshold relies on staff-line height. Then connected 0.5 techniques [26] were applied and derivation methodology therefore on notice the staff-lines. Eventually, the staff-line that is detected was mapped to the first image. Thus all objects except the staff-lines could also be detected.
Imani*et al.* introduced a technique to better the classification performance of hyperspectral pictures with the mixture of principal part analysis (PCA) [27], genetic formula (GA) [28], and artificial neural networks (ANNs) [29]. First, some options of the hyperspectral area unit investigated. Principal part analysis was employed to record the most knowledge existing within the hyperspectral pictures and reduce its spatiality consequently. Then, neural networks area unit accustomed classify the reduced hyperspectral knowledge. The back-propagation neural network used was simple to suffer from the native minimum flinch so; a genetic formula was adopted to correct the BP network's weights and so the brink which can higher the HSI's.
Biancardi*et al.* proposed a new paradigm to subsume connected part was conferred. It depends on a high level graph-based model, referred to as associative nets, that permits a world manipulation of connected parts by suggests that of specific inter-pixels graphs in a picture. This model may be a terribly economical tool of image analysis [30] and permits versatile handling of regions and contours

III. METHODOLOGY

In this thesis work, a new method is proposed for better restoration of hyper spectral images in a document. The proposed work is based on the Low-Rank Matrix Recovery and Neural Network with Median technique.

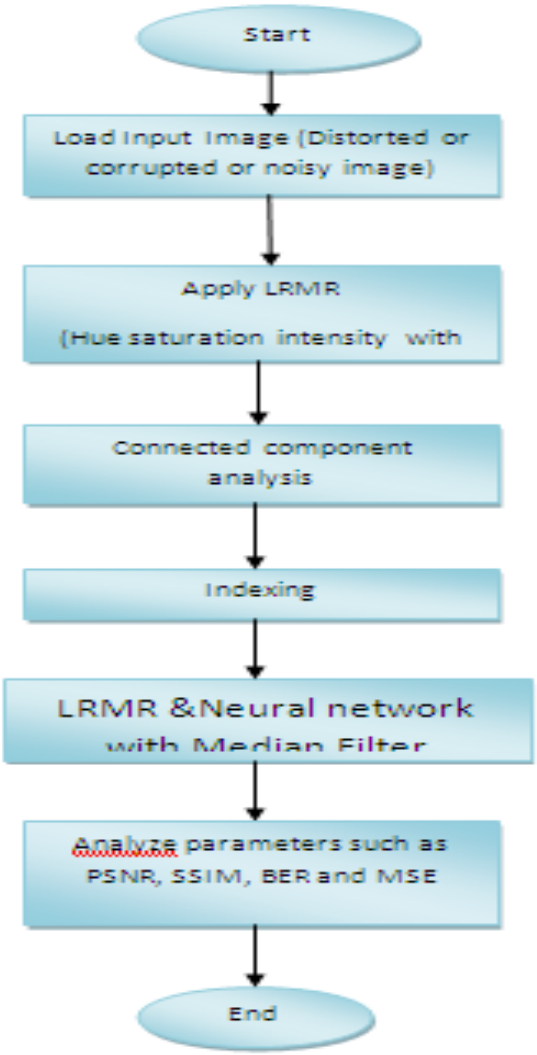
Low-Rank Matrix Recovery

Digital image methodology plays a very important role within the investigation and rationalization of remotely perceived knowledge. Image restorations techniques ease in enhancing the visibility of any zero.5 or feature of the image by dominant the knowledge in many parts or properties. Image restoration improves the clarity of objects within the scene by increasing the shine feature between objects and their backgrounds. Image restorations unit usually conducted as a distinction stretch followed by a tonal restoration.

Neural Network (NN)

A NN may be a machine learning approach galvanized by within which the brain performs a selected learning task. A neural network is associate assessing style that consists of massively parallel relation of adaptation 'neural' processors. As a result of its parallel nature, it'll conduct calculations at a high ranking as compared to the classical techniques. As a result of its variable nature, it wills befits changes among the information and learn the characteristics of sign. Outcome from one node is delivered to more one among the network and thus the top product depends on the advanced correlation of all nodes.

The following flow chart shows the proposed algorithm:-



IV. EXPERIMENTAL RESULTS

Implementation is finished on MATLAB. Experimental results of intermediate steps show the efficiency of the projected approach. Inside the subsequent figures, results of all the intermediate steps of the projected formula highlighted.

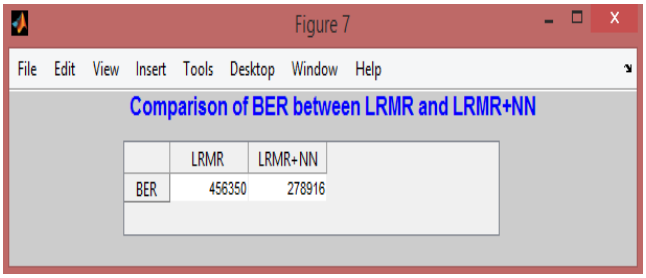


Figure 1: Bit Error Rate

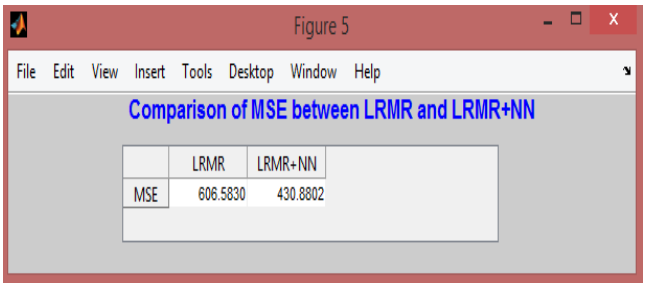


Figure 2: Mean Square Error

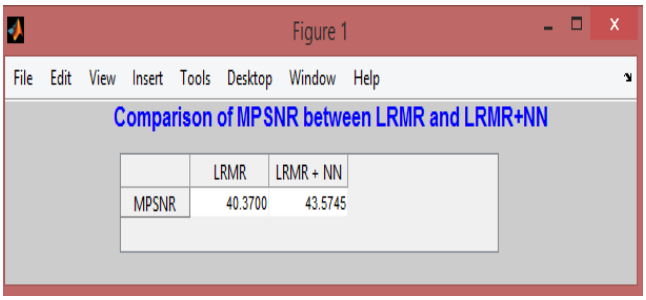


Figure 3: MPSNR values of previous and proposed algorithms

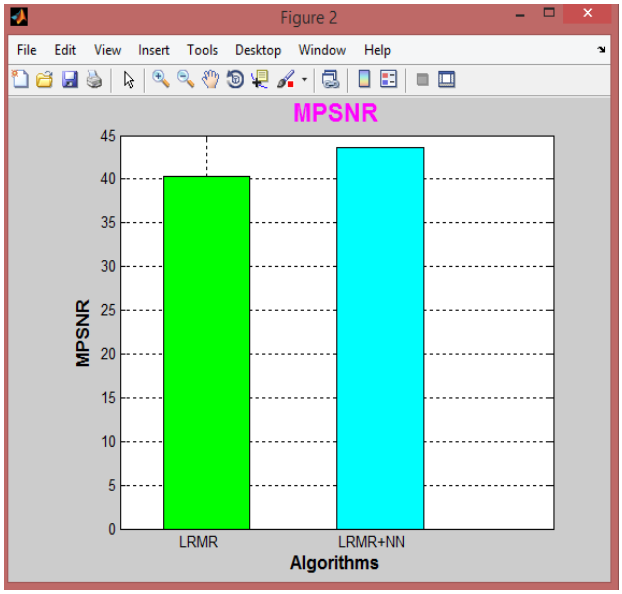


Fig. 4: Graphical representation of MPSNR values of previous and proposed algorithms

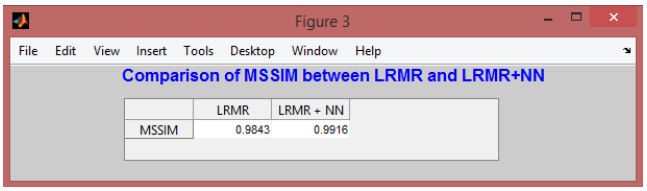


Figure 5: MSSIM values of previous and proposed algorithms

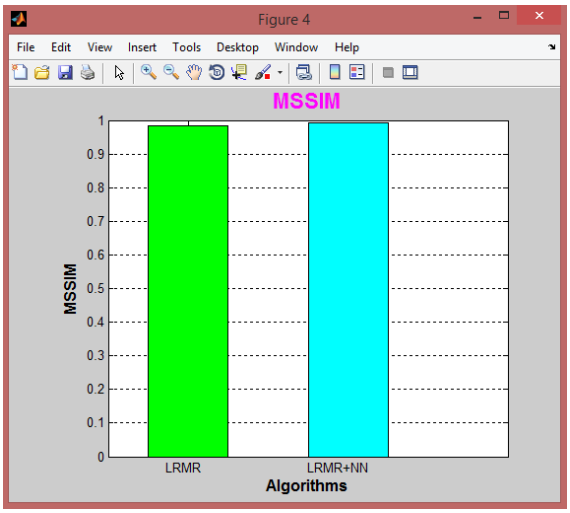


Fig.6: Graphical representation of MSSIM values of previous and proposed algorithms

V.CONCLUSION

- PSNR of the proposed algorithm has risen up to 3.2 % from the previous algorithm which is very good.
- SSIM for the image has improved from 0.98 dB to 0.99 dB.
- MSE has obtained using the proposed method. MSE is 430.88 dB for the image.
- BER has obtained using the proposed algorithm. It is 0.22 dB for the image.
- The improvement in terms of PSNR, SSIM, MSE and BER is obtained using the proposed algorithm.

Future Scope

The proposed method shows good result in terms of PSNR, BER, MSE and SSIM. But in future more parameters like quality, Image Quality Index, etc. can be considered. New formulas or algorithm like SVM, DCT and many more for the restoration of hyper spectral images can be used. The planned algorithm can also be implemented on different tools.

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