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Wireless Sensor Network Image Compression Based on Clustering & Swarm Optimization

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ABSTRACT

Multimedia data compression is a challenging job for compression technique, due to the possibility of loss of data and required large amount of storage place. The minimization of storage place and proper transmission of these data needed compression. Now in these days various image compression techniques are used. Some compression technique is lossless, and some compression technique is loss. The process of lossless compression technique is slow and takes more time for compression. In the series of compression technique one method are available such method is called DWT image compression technique. The DWT image compression technique is very efficient image compression technique due to the property of symmetry. The property of symmetry reduces the selection time of block. But the process produces lossy image compression. Some authors used some other technique along with DWT transform function and produces lossless image compression technique.
Keywords: Image, JPEG, DWT, Compression, Clustering.

I. Introduction

Image compression techniques may be divided into two ways namely, lossy and lossless compression. Irrespective of the advantages of lossy compression, they are not used in medical science due to fact that in lossy compression, some important data may be over-ridden due to compression, which do not happen in lossless compression. Lossy compression is generally used in streaming media and telephone applications. Some algorithms for lossy and lossless compression are presented here. Most of image compression techniques discussed over the years are mostly spatial based by some encoding or decoding logic based on processing the images by dividing them into small blocks. Nobuhara et al. discussed a fast image compression technique using fuzzy relational equation. Mohammed et al. discussed an image compression technique based on block truncation coding. They divided the image into non-overlapping blocks and applied the coding technique. Chang et al. presented an adaptive wavelet thresholding technique for image compression, with the threshold being driven by a Bayesian framework. Several image compression techniques particularly for grey scale images have also been discussed. A new technique based on invariant image features, is discussed. Initially, a standard lossy image compression technique existed known as JPEG, which is based on Discrete Cosine Transform (DCT). It was later replaced by the JPEG2000. Evolutionary optimization algorithms have also been used by some researchers, to decrease the computational time. In the rest part, section II-cluster algorithm, section III-proposed algorithm, section IV-result analysis and finally conclusion and future work.

II. CLUSTER ALGORITHM

The cluster algorithms apply for the find comparable and disparate bundle reference for the creation of code book. The bunch calculation assembles the parcel, for this situation utilized k-implies calculation. K-implies is maybe the most well-known bunching strategy in metric spaces. At first k bunch centroids are chosen indiscriminately; k-implies then reassigns every one of the focuses to their closest centroids and recomputed centroids of the recently gathered gatherings. The iterative movement proceeds until the point when the model capacity, e.g. square-blunder combines. Regardless of its wide ubiquity, k-implies is extremely delicate to commotion and anomalies since few such information can generously impact the centroids. Different shortcomings are affectability to introduction, entanglements into neighbourhood optima, poor group descriptors, and powerlessness to manage bunches of discretionary shape, size and thickness, dependence on client to determine the quantity of bunches.

Basically, k-Means Clustering is a calculation among a few that endeavours to discover bunches in the information. In pseudo code, it is appeared to pursue this system:

Initialize $\mathbf{m}_i$, i = 1,…,k, for example, to k random $\mathbf{x}^t$

Repeat

For all $\mathbf{x}^t$ in X

$b_i^t \leftarrow 1$ if $\| \mathbf{x}^t - \mathbf{m}_i \| = \min_j \| \mathbf{x}^t - \mathbf{m}_j \|$

$b_i^t \leftarrow 0$ otherwise

For all $\mathbf{m}_i$, $i = 1,\dots,k$

$\mathbf{m}_i \leftarrow$ sum over t $(b_i^t \mathbf{x}^t)$ / sum over t (b_i^t)

Until $\mathbf{m}_i$ converge

The vector **m** contains a reference to the sample mean of each cluster. **x** refers to each of our examples, and **b** contains.

1. Choose some manner in which to initialize the m_i to be the mean of each group (or cluster) and do it.
2. For each example in your set, assign it to the closest group (represented by m_i).
3. For each m_i, recalculate it based on the examples that are currently assigned to it.
4. Repeat steps 2-3 until m_i converge.

Now that we have some rudimentary understanding of what k-means is, what are some practical applications of it?

III PROPOSED ALGORITHM

The proposed algorithm is combination of two algorithm one is wavelet transform function and other is particle swarm optimization. The wavelet transform function used for the processing of raw image for the purpose of decomposition of image. The particle of swarm optimization used for the purpose of searching a coefficient of the similarity for making code matrix. The head code coder finally generates compressed image. The proposed algorithms divide into three level. The process of level describes here.

Level 1:

1. Process the input image.
2. Call function of DWT(2) transform function for the generation of HF and LF.
3. Preserve the HF part of image.
4. Further decomposed the value of LL and measure horizontal, vertical and diagonal
5. The coefficient of transform function mapped in artificial particle.
6. The particle swarm optimization algorithms estimate optimal coefficient.
7. Process for similar coefficient, k-means algorithm.
8. Measure the similar coefficient and separate redundant and non-redundant coefficient

Level 2:

1. Define the value of particle N=1000;
2. Selection of fitness function
   $fitness = V(r1, r2)/M(ri)$
3. Process all coefficient in terms of particle
4. Assign velocity as r1-r2=x
5. Check Ri €V
   x=0;
6. Check Ri €V
   xij=x(ri,rj)
7. if(x=1) then packet is redundant
8. else
9. packet is redundant
10. two block code are generating one is redundant and another is non-redundant

level 3:

1. pass in HCC
2. input image compressed
3. estimate value of MSE
4. estimate value of PSNR
5. estimate value of SSIM.
6. Exit

PROPOSED MODEL

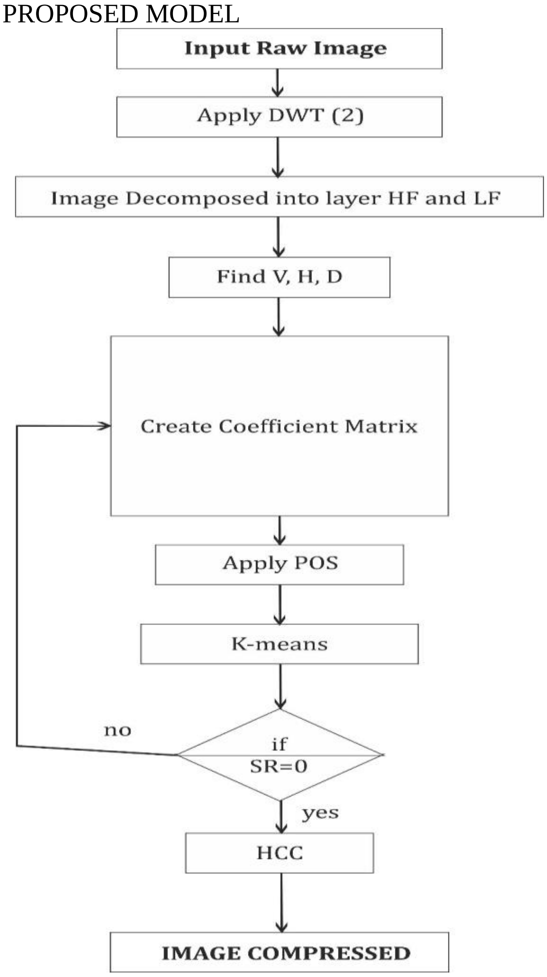

Figure 1: Proposed model of image compression.

IV RESULT ANALYSIS

1. FOR NEST IMAGE

ORIGINAL IMAGE | COMPRESSED IMAGE

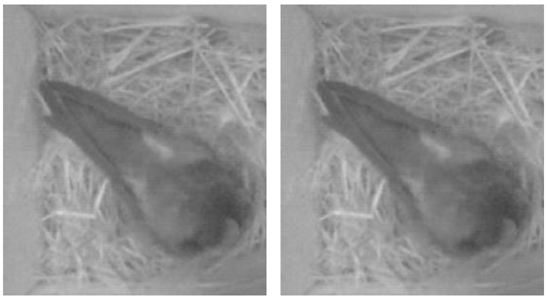

Figure 2: show that the comparative nest image of before compression and after compression.

METHOD	MSE	PSNR	SSIM
Base Paper result	3.33	42.90	0.9846
CLUSTER-BASED	3.9886	42.247099	0.89362
PROPOSED	1.9886	43.247099	0.99362

Table 1: show the comparative analysis between cluster-based method and proposed method using nest image. Find out the Mean Square Error (MSE), PSNR, SSIM numeric result for both methods.

2. FOR EGG IMAGE

ORIGINAL IMAGE | COMPRESSED IMAGE

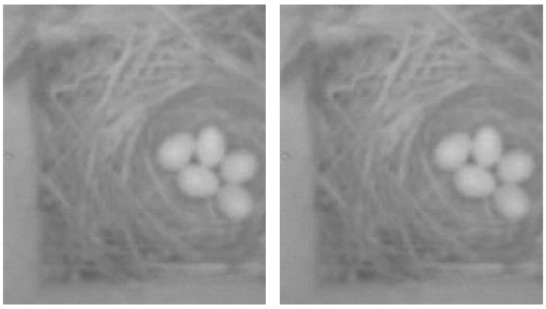

Figure 3: show that the comparative egg image of before compression and after compression.

METHOD	MSE	PSNR	SSIM
BASE PAPER	2.06	44.99	0.9901
CLUSTER-BASED	2.7690	41.526773	0.85067
PROPOSED	0.7690	42.526773	0.95067

Table 2: show the comparative analysis between cluster-based method and proposed method using nest image. Find out the Mean Square Error (MSE), PSNR, SSIM numeric result for both methods.

METHOD	Compression Ratio	$E_{compression}$ (MJ)	Energy Gain	Encoding time
CLUSTERBASED	40.247099	37.247099	62.247099	1.512324
PROPOSED	45.247099	48.247099	33.247099	1.559690

Table 3: show the comparative analysis between cluster-based method and proposed method using nest image. Find out the compression ratio (CR), Ecompression, Energy Gain, encoding time according to used image 11.jpg numeric result for both methods.

METHOD	Compression Ratio	$E_{compression}$ (MJ)	Energy Gain	Encoding time
CLUSTERBASED	39.526773	36.526773	61.526773	3.061331
PROPOSED	44.526773	47.526773	32.526773	1.291868

Table 4: show the comparative analysis between cluster-based method and proposed method using nest image. Find out the compression ratio (CR), Ecompression, Energy Gain, encoding time according to used image 22.jpg numeric result for both methods.

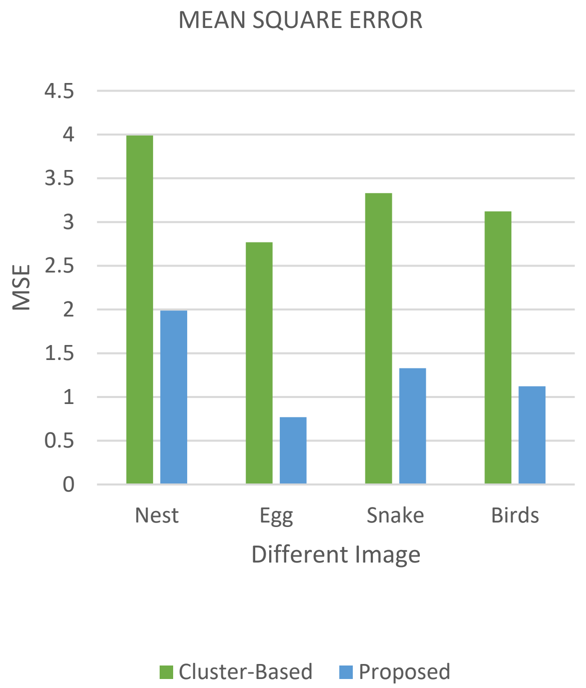

Figure 4: show that the comparative performance between cluster-based method and proposed method for Mean Square Error (MSE) using different images nest, egg, snake, birds.

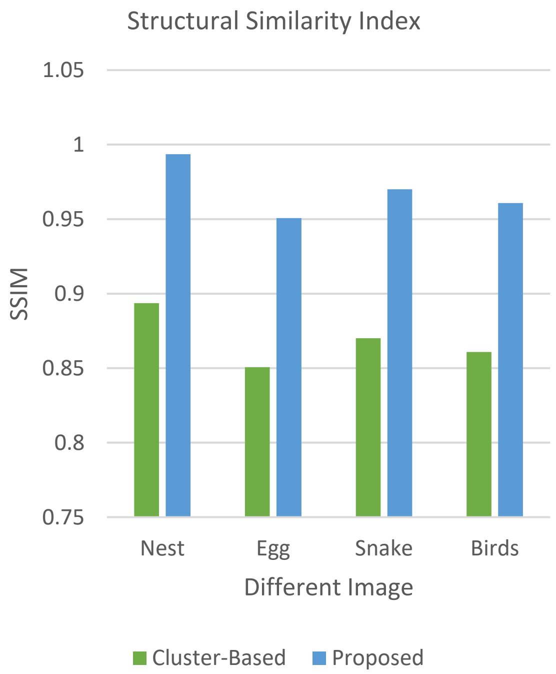

Figure 6: show that the comparative performance between cluster-based method and proposed method for Structural Similarity Index (SSIM) using different images nest, egg, snake, birds.

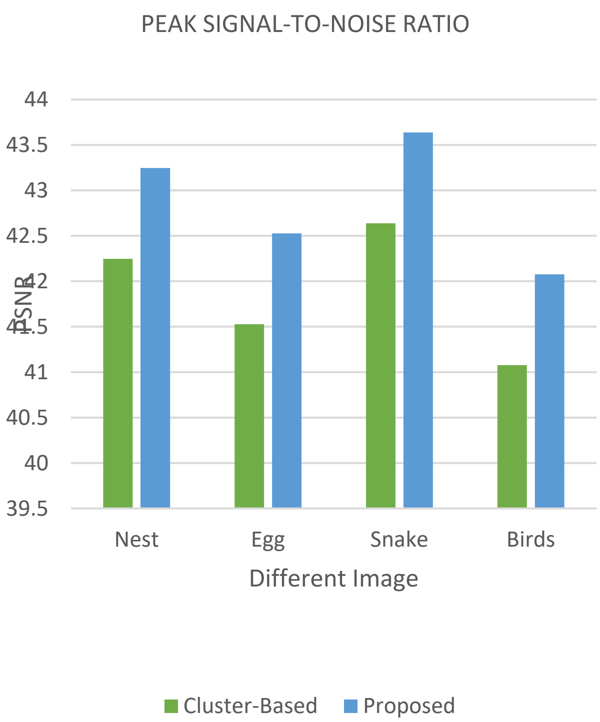

Figure 5: show that the comparative performance between cluster-based method and proposed method for PSNR using different images nest, egg, snake, birds.

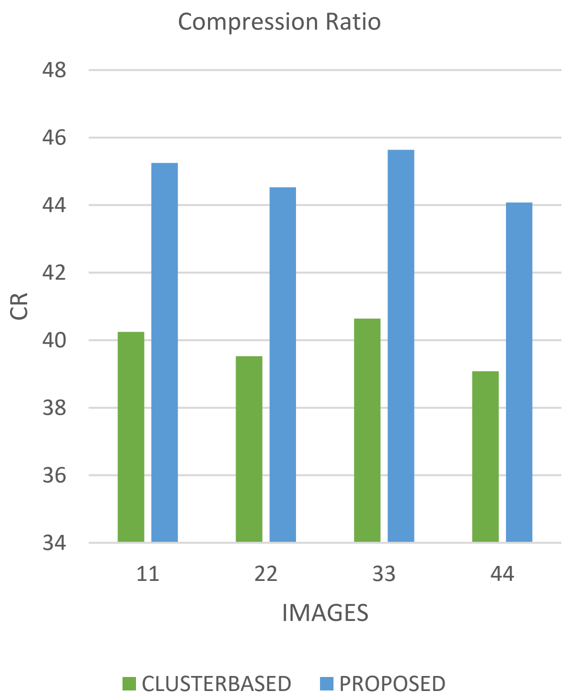

Figure 7: show that the comparative performance between cluster-based method and proposed method for compression ratio (CR) using different images 11=nest, 22=egg, 33=snake, 44=birds.

V. Conclusion & Future Scope

The proposed work simulate with matlab software V. 7.14.0. approach used hear wavelet faimly process for picture's decompostion. The decomposed transfrom function passes through coding and generates packet transfrom. For the connectivity of proposed algorithm used another image compression technique such as cluster-based method and proposed method. For the valuation of parameter used two standard parameter one is MSE, PSNR, SSIM, $E_{compression}$, Energygain, Encoding Time and another is compression ratio. Our emprical valaution of MSE, PSNR, SSIM, $E_{compression}$, Energygain, Encoding Time and C.R shows that better value in comression of other compression algorithm. The proposed algorithm is very efficient in terms of MSE, PSNR, SSIM, $E_{compression}$, Energygain, Encoding Time value and C.R instead of cluster-based algorithm compression technique. But little point of disappoint in terms of computational time because the search and optimization of structure reference packet more time and its increase the computational time, in future reduce the computational time for efficient processing.

References

[1] Jeongyeup Paek and Jeong Gil Ko "K-Means Clustering-Based Data Compression Scheme for Wireless Imaging Sensor Networks", IEEE, 2017, Pp 2652-2662.

[2] Nameirakpam Dhanachandra, Khumanthem Manglem and Yambem Jina Chanu "Image Segmentation using K -means Clustering Algorithm and Subtractive Clustering Algorithm", Eleventh International Multi-Conference on Information Processing, 2015, Pp 764 – 771.

[3] Mou Wu, Liansheng Tan and Naixue Xiong "Data prediction, compression, and recovery in clustered wireless sensor networks for environmental monitoring applications", Information Sciences, 2016, Pp 800–818.

[4] Mark Coatsworth, Jimmy Tran and Alexander Ferworn "A Hybrid Lossless and Lossy Compression Scheme for Streaming RGB-D Data in Real Time", IEEE, 2017, Pp 1-6.

[5] Rajib Banerjee, Sibashis Chatterjee and Sipra Das Bit "An energy saving audio compression scheme for wireless multimedia sensor networks using spatio-temporal partial discrete wavelet transform", Computers and Electrical Engineering, 2015, Pp 389–404.

[6] Matteo Gaetaa, Vincenzo Loiab and Stefania Tomasiello "Cubic B–spline fuzzy transforms for an efficient and secure compression in wireless sensor networks", Information Sciences, 2016, Pp 19–30.

[7] Enyan Sun, Xuanjing Shen, Haipeng Chen and Chuanyun Wang "Distributed Image Compression and Transmission Scheme in Wireless Multimedia Sensor Networks", TELKOMNIKA Indonesian Journal of Electrical Engineering, 2014, Pp 661-668.

[8] Li-bo Zhang, Zhi-liang Zhu, Ben-qiang Yang, Wen-yuan Liu, Hongfeng Zhu and Mingyu Zou "Medical Image Encryption and Compression Scheme Using Compressive Sensing and Pixel Swapping Based Permutation Approach", Hindawi Publishing Corporation, 2015, Pp 1-10.

[9] Sujoy Paul and Bitan Bandyopadhyay "A Novel Approach for Image Compression Based on Multi-level Image Thresholding using Shannon Entropy and Differential Evolution", IEEE, 2014, Pp 56-61.

[10] Tanima Dutta "Medical Data Compression and Transmission in Wireless Ad Hoc Networks", IEEE, 2015, Pp 778-786.

[11] Nitu Rani and Savita Bishnoi "Comparative Analysis of Image Compression Using DCT and DWT Transforms", International Journal of Computer Science and Mobile Computing, 2014, Pp 990 – 996.

[12] Christos Boutsidis, Anastasios Zouzias, Michael W. Mahoney and Petros Drineas "Randomized Dimensionality Reduction for k-Means Clustering", IEEE, 2015, Pp 1045-1062.

[13] Neha S. Korde and Dr. A. A. Gurjar "Wavelet Based Medical Image Compression for Telemedicine Application", AJER, 2014, Pp 106-111.

[14] Stephan A. Rein, Frank H.P. Fitzek, Clemens Gühmann and Thomas Sikora "Evaluation of the wavelet image two-line coder: A low complexity scheme for image compression", Signal Processing: Image Communication, 2015, Pp 58–74.