A Study of Wireless Sensor Image Compression Scheme Method Using Clustering Technique

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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

The aim of data compression is to reduce the memory space or the transmission time, especially for wireless sensor networks (WSNs) because of the energy constraints. In the past, data compression and cryptography were kept separated because any data can be compressed if necessary and then encrypted. Anyway because of the rapid progress in computing technology, the encrypted data could be secure no longer in a few years. A way to increase security is joining compression and encryption, using one of the existing cryptography techniques. This scheme has been adopted especially for images. In the case of WSNs, since sensors have both limited memory and storage space and power limitations, the most part of the traditional techniques turns out to be not suitable, by requiring a certain amount of resources such as data memory, code space and energy. This is principally due to the fact that such techniques use asymmetric cryptography, where there is a public key to encrypt data and a private key to decrypt them. Asymmetric cryptography is computationally expensive for the individual nodes in a sensor network, even if some authors showed that it is feasible by choosing the right algorithms. So symmetric cryptography is the typical choice when the computational complexity of asymmetric cryptography cannot be afforded. Symmetric schemes utilize a single shared key known only between the two communicating hosts, which is used for both encrypting and decrypting data. Typical symmetric schemes are RC5 and AES. With regard to the compression techniques available in WSNs, one can refer to for a comprehensive survey. In general, nodes, which are able to collect, to process data and sharing them with neighbouring nodes, are required to be relatively inexpensive, in terms of power supply, memory capacity, communication bandwidth, and processor performance. Since mostly the energy consumption is due to radio communication, compression techniques allow lesser communication energy costs. A well-known approach in the WSN field is the discrete wavelet transform (DWT), which performs well for spatially and temporally correlated data, but this could not be true for outdoor environments. They showed the good performance of an F–transform based approach when compared to the usual DWT approach, by finding out a high enough value of the compression rate with a lower distortion.

II. Related Work

Jeongyeup Paek and Jeong Gil Ko Et al. [1] They develop an image compression scheme using K-means clustering on low-power embedded devices for image-based WSNs. Specifically, they use the similarity of pixel colors to group pixels and compress the original image. Using 100 000 images collected from their pilot deployments at the James Reserve, they study the applicability and impact of the discussed K-means clustering-based compression algorithm. This work focuses on the efficient processing of image data generated from low-power camera sensors that operate on resource-limited embedded computing platforms. Specifically, they apply the K-means clustering-based learning algorithm to compress the image data collected on these platforms.

Nameirakpam Dhanachandra, Khumanthem Manglem and Yambem Jina Chanu Et al. [2] Image segmentation is the classification of an image into different groups. Many researches have been done in the area of image segmentation using clustering. There are different methods and one of the most popular methods is k-means clustering algorithm. K -means clustering algorithm is an unsupervised algorithm and it is used to segment the interest area from the background. They have segmented an image by using k-clustering algorithm, using subtractive cluster to generate the initial centroid. The output images are also tune by varying the hyper sphere cluster radius and they can conclude from that result that by varying the hyper sphere cluster radius they can get different output. And so, they should take the value of hyper sphere cluster very carefully.

Mou Wu, Liansheng Tan and Naixue Xiong Et al. [3] They discussed a novel framework with dedicated combination of data prediction, compression, and recovery to simultaneously achieve accuracy and efficiency of the data processing in clustered WSNs. The main aim of the framework is to reduce the communication cost while guaranteeing the data processing and data prediction accuracy. All errors generated in these processes are finally evaluated theoretically, which come out to be controllable. Based on the theoretical analysis, they design a number of algorithms for implementation. Simulation results by using the real-world data demonstrate that their framework provides a cost-effective solution to such as environmental monitoring applications in cluster based WSNs.

Mark Coatsworth, Jimmy Tran and Alexander Ferworn Et al. [4] they consider the problem of live streaming RGB-D data over wired and wireless communication channels, using low-power, embedded computing equipment. When assessing a disaster environment, a range camera is typically mounted on a ground or aerial robot along with the onboard computer system. Ground robots can use both wireless radio and tethers for communications, whereas aerial robots can only use wireless communication. they discussed a hybrid lossless and lossy streaming compression format designed specifically for RGB-D data and investigate the feasibility and usefulness of live-streaming this data in disaster situations.

Rajib Banerjee, Sibashis Chatterjee and Sipradas Bit Et al. [5] The availability of low-cost hardware and advancement in short range radio communication has enabled the development of wireless multimedia sensor networks (WMSNs). The WMSNs can process multimedia data such as video and audio streams, still images collected from the application area. Energy is one of the scarcest resources in such networks. In-network processing is one of the techniques to save energy and data compression is one of the implementing techniques of in-network processing. They subsequently design a tree-based routing scheme and an encoding scheme to be used with the discussed compression scheme with a target to reduce energy further. Finally, the design feasibility along with simulation results, including statistical analysis is presented to evaluate efficacy of the scheme in terms of two conflicting parameters viz. energy consumption and SNR.

Matteo Gaetaa, Vincenzo Loiab and Stefania Tomasiello Et al. [6] The aim of data compression is to reduce the memory space or the transmission time, especially for wireless sensor networks (WSNs) because of the energy constraints. A way to increase security is joining compression and encryption, using one of the existing cryptography techniques. They discussed a cubic B–spline F–transform in order to have a higher accuracy, even when data are not correlated, and a lo they r computational cost. The parameters required to decompress data are encrypted by means of a suitable existing encryption algorithm. they show that even if an illegal user had access to one of these parameters, their scheme would be still secure.

Enyan Sun, Xuanjing Shen, Haipeng Chen and Chuanyun Wang Et al. [7] Wireless multimedia sensor networks will have a variety of applications. Meanwhile, WMSNs produce a large amount of image data. JPEG2000 is the popular image compression standard and have some advantages. This paper has studied the distributed image compression and transmission scheme in WMSNs. DICT is discussed to lessen the individual sensor node's burden of computation, memory and energy. DICT can balance the energy consumption of sensor nodes in networks and extend the network lifetime. Simulation experiment shows that DICT is better than centralized image compression and transmission scheme such as CCIS and CHIS in the energy consumption balance and the network lifetime.

Libo Zhang, Zhi-liang Zhu, Ben-qiang Yang, Wen-yuan Liu, Hongfeng Zhu and Mingyu Zou Et al. [8] This paper presents a solution to satisfy the increasing requirements for secure medical image transmission and storage over public networks. The discussed scheme can simultaneously encrypt and compress the medical image using compressive sensing (CS) and pixel swapping based permutation approach. A medical image encryption and compression scheme has been discussed. they employed compressive sensing to firstly compress and encrypt the plaintext, and the measurement matrix is generated using chaotic Chebyshev map. Simulations and security analyses have demonstrated the satisfactory compression and encryption performances of the discussed scheme.

Sujoy Paul and Bitan Bandyopadhyay Et al. [9] In this paper, a histogram-based image compression technique is discussed based on multi-level image thresholding. The gray scale of the image is divided into crisp group of probabilistic partition. An image thresholding base dd algorithm is discussed for image compression. Shannon's Entropy is maximized to obtain the best threshold Differential Evolution is used to reduce the computational time by a great extent. The background of the discussed algorithm is explained with proper reasoning. Several applications of the discussed algorithm have also been pointed out. It may be mentioned here that there exist several other entropy measures, which performs well in segmenting the image properly.

Tanima Dutta Et al. [10] They discussed an optimization-based medical data compression technique, which is robust to transmission errors. They discussed a fuzzy-logic-based route selection technique to deliver the compressed data that maximizes the lifetime of WANETs. The technique is fully distributed and does not use any geographical/location information. They discussed the RMM system for routing the medical data of patients in the disaster area. The coding technique in RMM system allows to decode correctly even in the presence of transmission errors. RMM system exploits the attributes of WANETs to maintain QoS of WANETs.

Nitu Rani and Savita Bishnoi Et al. [11] The main purpose of image compression is to reduce the redundancy and irrelevancy present in the image, so that it can be stored and transferred efficiently. Depending on the reconstructed image, to be exactly same as the original or some unidentified loss may be incurred, two techniques for compression exist. Two techniques are: lossy techniques and lossless techniques. They are analysing comparative performance of DCT & DWT transforms based on various parameters.

Christos Boutsidis, Anastasios Zouzias, Michael W. Mahoney and Petros Drineas Et al. [12] They studied the problem of dimensionality reduction for k-means clustering. Most of the existing results in this topic consist of heuristic approaches, whose excellent empirical performance cannot be explained with a rigorous theoretical analysis. Their focus was on dimensionality reduction methods that work well in theory. they presented three such approaches, one feature selection method for k-means and two feature extraction methods. The theoretical analysis of the discussed methods is based on the fact that dimensionality reduction for k-means has deep connections with low-rank approximations to the data matrix that contains the points one wants to cluster.

Neha S. Korde and Dr. A. A. Gurjar Et al. [13] They discuss about a simple and lossless compression method for compression of medical images. Method is based on wavelet transform of medical application. They focus is on the implementation of lossless image data code, when the input image data is encrypted before using compression technique. Hence this is more suitable for the transmission of Medical images for Telemedicine application. they are using different types of wavelet-based compression which has much better coding efficiency and less computational complexity.

Stephan A. Rein, Frank H.P. Fitzek, Clemens Gühmann and Thomas Sikora Et al. [14] This paper introduces the wavelet image two-line (Wi2l) coding algorithm for low complexity compression of images. As demonstrated in this paper, a compression performance similar to JPEG 2000 and the more recent Google WebP picture compression is achieved. The compression system uses flash memory (SD or MMC card) and a small camera sensor thus building an image communication system. It is also suitable for mobile devices or satellite communication. They have discussed and evaluated a wavelet-based algorithm that allows for effective image compression on very limited platforms. The discussed algorithm reorders the bit stream such that the coding can be conducted line-wisely.

III. PROBLEM STATEMENT

The problem is even more severe when a block crosses an image boundary. Here, they really pulverize important picture data and the scandalous blocky curios of the JPEG pressure show up. A consistent result in enhancing such calculations is to be less visually impaired. In this manner, one uses semantic picture data, the alleged picture highlights, similar to edges or corners, to choose which are the imperative data substance of the picture one needs to save in the pressure step. The problem of image compression based on wavelet packet is mentioned in following step:

- The parent–child relationships of tree structures are difficult to define, and the probability of zero-trees are greatly reduced in the Wavelet Packet.
- Complex quantization process of JPEG.
- Bad PSNR in images of rich textures and higher visual quality in the region of texture area.
- Difficult to design structure reference.

IV. PARTICLE OF SWARM OPTIMIZATION

The PSO is a populace put together hunt calculation based with respect to the recreation of the social conduct of winged animals, honey bees or a school of fishes. PSO at first means to graphically re-enact the effortless and eccentric movement of a winged creature people. Every person inside the swarm is spoken to by a vector in multidimensional inquiry space. This vector has likewise one doled out vector which decides the following development of the molecule and is known as the speed vector. The PSO additionally decides how to refresh the speed of a molecule. Every molecule refreshes its speed dependent on current speed and the best position it has investigated up until now; and furthermore, dependent on the worldwide best position investigated by swarm. The PSO procedure at that point is iterated a settled number of times or until the point that a base mistake dependent on wanted execution file is accomplished. It has been demonstrated that this straightforward model can manage troublesome enhancement issues proficiently. The PSO was initially created for genuine esteemed spaces yet numerous issues are, be that as it may, characterized for discrete esteemed spaces where the area of the factors is limited.

Calculation technique

1. Initialize Population
2. Calculate fitness values of particles modify the best particles in the swarm Choose the best particle
3. Calculate the velocities of particles
4. Update the particle positions
5. until requirements are met

Particles are introduced by doling out arbitrary positions in the hunt space. Speeds are instated haphazardly in the range $[\upsilon_{min}, \upsilon_{max}]$. In every emphasis another speed is determined for every molecule and the new position is resolved as the total of the past position and the new speed.

$$x(t+1) = x(t) + \upsilon(t+1)$$

While updating the new velocity, the best position of current particle achieved so far (p(t), particle best) and the best position achieved so far by all particles (g(t), global best) are used this:

$$\upsilon(t+1) = \omega\upsilon(t) + \varphi 1 rand(0,1)(p(t) - x(t) + \varphi 2 rand(0,1)(g(t) - x(t))$$

Where ω is inertia weight which controls the magnitude of the old velocity $\upsilon(t), \varphi 1$ *and* $\varphi 2$ determine the significance of $p(t)$ and $g(t)$, respectively. Furthermore, υ_i at any time step of the algorithm is constrained by the parameter υ_{max}.

V. CONCLUSION & FUTURE SCOPE

In this desertation proosed a cluester based image compression technique.the cluester based image compression techniqe used k-means cluestering technique for the grouping of packet. In the particle of swarm optimization process define the fitness constraints according to the diffrence value of structure refrence packet. If diffrence of packet is zero value assigned 1 and the diffrence value get value assined 0. both similar and disimilry packet collect in two different unit and paases throgh HCC matrix after that image is compressed. At 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.

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