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Plenoptic Image Compression for Reduced Loss Using Ant Colony Optimization

Prikshit Singh Chib
CGC College of Engineering
Mohali, India

Amanpreet Kaur
Asstt.Prof. CGC College of Engineering
Mohali, India

Abstract-Digital images have become popular for transferring, sharing, storing and visual information and hence high speed compression techniques are needed because the uncompressed multimedia (graphics, audio and video) information requires significant capacity limit and transmission transfer speed. Dust, rain, fog, snow, murky water and insufficient light can cause even the most sophisticated vision systems to fail. Plenoptic cameras offer an appealing alternative to conventional imagery by gathering significantly more light over a wider depth of field, and capturing a rich 4D light field structure that encodes textural and geometric information. The key contributions of this work lie in exploring the properties of plenoptic signals and developing algorithms for exploiting them.

Keywords- Image Compression, ACO (Ant Colony Optimization), light field, plenoptic image.

I. INTRODUCTION

The digital light field camera was introduced by Ren Ng in [1], where a microlens array was used to sample angular information about the light rays . Plenoptic image is a novel visual representation that contains more information than traditional images. Different focal planes and different perspectives can be recovered by a rendering algorithm. The effective resolution of the plenoptic camera is very low compared to the image captured [2-5]. This is because it sacrifices spatial resolution to capture information about the angle of the light ray, which is useful in many applications. Many works attempts to increase the effective resolution using super-resolution techniques [6-7].

Social and network computing demands effective, imparting and sparing of image information, which has dependably been an awesome test. Individuals are imparting, transmitting and putting away a great many each moment. Despite the fact that, data compression is for the most part done to dodge the inhabitance of more memory, and upgrade limit of capacity gadgets, generation of digital images has been expanded extent [8]. Thus, the interest of flawless, image compression algorithm is very high which can be utilized to lessen the assets utilization, for example, data storage space or transmission capacity. An approach of reducing the volume of graphics file in bytes without influenced image quality to unacceptable level. This minimization in size enables more images storage in an available memory space and cut down the transmission duration that is demanded by an image to be downloaded over the Internet.

Two essential and basic parts are reducing redundancy and irrelevancy. Reducing Redundancy focuses to reproduce exactly from the image. Parts of the image are omitted unnoticed by the receiver from naked eye namely Human Visual System in irrelevancy reduction. The use of digital images is increasing rapidly. Along with this increasing use of digital images comes the serious issue of storing and transferring the huge volume of data representing the images because the uncompressed multimedia (graphics, audio and video) information requires significant capacity limit and transmission transfer speed.

Image compression is very important for efficient transmission and storage of images. Demand for communication of multimedia data through the telecommunications network and accessing the multimedia data through Internet is growing explosively. With the use of digital cameras, requirements for storage, manipulation, and transfer of digital images, has grown explosively. From last few decays, the increasing demand of storage and transmission of digital images, image compression is now become an essential application for storage and transmission [9]. Demand for communication of multimedia data through the telecommunications network and accessing the multimedia data through Internet is growing explosively [10]. With the use of digital cameras, requirements for storage, manipulation, and transfer of digital images, has grown explosively. There are many image compression techniques available, but still there is need to develop faster, and more strong and healthy techniques to compress images. Because, main difficulties in developing compression algorithms for image is the need for preserving the minutiae i.e. ridges endings and bifurcations, which are subsequently used in identifications.

There are a few researches in compression of this new data representation [11-14], but the path to standards devoted to this specific type of image is a long road. Standards like JPEG [15] and JPEG2000 [16] are very well established, including hardware and image editing software support. Using them is advantageous on the commercial point of view, since adapting them are cheaper than establishing a new standard. There is also the SPIHT, which is a fast algorithm with better results than JPEG, but it does not have any commercial version [17-18].

The main contribution of this work is the study of the plenoptic image compression behavior. It is used existing compression schemes and existing rendering algorithms without modification. This replicates a real scenario where commercial cameras are modified to capture plenoptic images, and seeks to answer if the application would be not hindered by the compression.

II. OBJECTIVE

- To collect plenoptic image data.
- To perform conversion of the plenoptic image data to RGB color data images using pixel dilation.
- To use wavelet band for frequency conversion of image and apply the compression using ACO based compression.
- To study change in PSNR, coding Error, Visual Index Ranking.

III. ANT COLONY OPTIMIZATION

Ant colony optimization (ACO) is a technique which can be used for various applications. Ant colony Optimization is an optimization technique that is based on the foraging behaviour of real ant colonies. Ant colony optimization is applied for the image processing which are on the basis continuous optimization.

The ant colony optimization algorithm (ACO) is a probabilistic strategy for tackling numerous issues which can be diminished to discovering great ways through diagrams. Albeit real ants are blind, they are equipped for discovering most brief way from nourishment source to their home by abusing a fluid substance, called pheromone, which they discharge on the travel course [19]. This algorithm is an individual any colony algorithm family, in swarm knowledge routines, and it constitutes some met heuristic optimizations. Ant Colony Optimization (ACO) is a population-based, general search technique for the solution of complex continuous problems which is inspired by the pheromone track laying behaviour of real ant colonies. The behaviour of ant is intimidated in artificial ant colonies for the search of estimated solutions to discrete optimization problems, to continuous optimization problems, and to important problems in telecommunications, such as routing and load balancing. At first proposed by Marco Dorigo in 1992 in his PhD theory, the first calculation was intending to look for an ideal way in a diagram, in view of the conduct of ants searching for a way between their state and a wellspring of sustenance. The ant colony optimization (ACO) metaheuristic a colony of artificial ants assists in finding good solutions to difficult discrete optimization problems [20]. The choice is to allocate the computational resources to a set of relatively simple agents (artificial ants) that communicate indirectly by stigmergy. Good solutions are an emergent property of the agents' cooperative interaction. The first thought has subsequent to enhanced to illuminate a more extensive class of numerical issues, and subsequently, a few issues have risen, drawing on different parts of the conduct of ants. The primary hidden thought, inexactly propelled by the conduct of real ants, is that of a parallel pursuit more than a few useful computational strings taking into account nearby issue information and on a dynamic memory structure containing information on the quality of previously obtained result. The collective behaviour rising up out of the connection of the distinctive hunt strings has demonstrated compelling in understanding combinatorial improvement (CO) issues. The developed AS strategy attempts to simulate behaviour of real ants with the expansion of a few manufactured attributes: perceivability, memory, and discrete time to determine numerous intricate issues effectively, for example, the travelling salesman problem (TSP) ,vehicle routing problem (VRP), and best path planning, Despite the fact that numerous progressions have been connected to the ACO algorithms during the past years, their fundamental ant behavioural mechanism that is positive criticism procedure showed by a state of ants is still the same. Ant's algorithm has also plenty of networking applications such as in communication networks and electrical distribution networks.

IV. ANT COLONY SYSTEM ALGORITHM

Different steps of a simple ant colony system algorithm are as follows.

A. Problem Graph Representation: Artificial ants move between discrete states in discrete situations. Since the Continuous problems solved by Ant Colony System algorithm are regularly discrete, they can be spoken to by a chart with N nodes and R routes.

B. Ants allocation Initializing: Various ants are set on the cause hubs. The quantity of ants is frequently defined based on trial and error and number of nodes in the region.

C. Ants possibility Distribution Rule:

Ant's probabilistic transition between nodes can also be specified as node transition rule as node transition rule.

D. Update Global Trail: When every ant has assembled a solution, at the end of each cycle, the intensity of pheromone is updated by a pheromone trail updating rule.

E. Stopping Procedure: This procedure is completed by arriving to a predefined number of cycles or the maximum number of cycles between two improvements of the global best solutions. Ant System's algorithm is important be a resident of mainly in being the prototype of a number of ant algorithms which have found many interesting and successful applications. In ant-cycle ants deposit pheromone after they have built a complete tour.

Objectives

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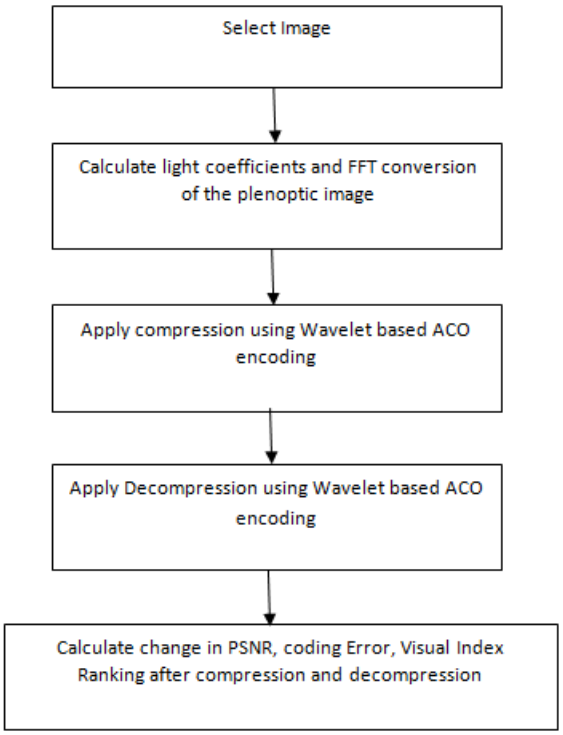
Proposed Methodology

- Select the target image
- Calculate the image size and calculate the light spread
- Use the trajectory of light for pixel mapping and perform Quantization using FFT
- Apply the compression with wavelet decomposition based ACO based encoding of wavelet components
- Recompose using the wavelet filter the compressed image
- Apply the decompression using the same system coding
- Calculate change in PSNR, coding Error, Visual Index Ranking after compression and decompression and compare with studied approach

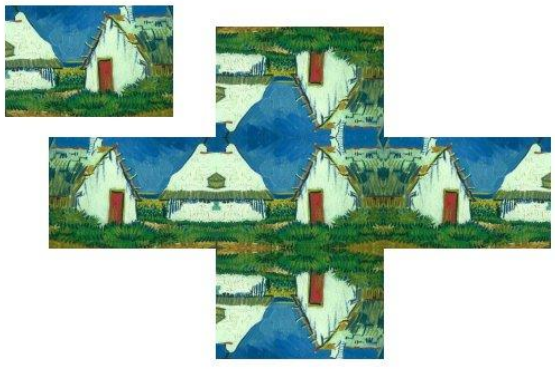
Block Diagram



V. RESULTS

The following section shows the output of the simulatedexperiment

The original image is extended with mirrored copies of itself.



Progressive encoding quality. The error compared to the relative size

size	rmse
100%	0.00
50%	8.34
25%	13.40
12.5%	17.22

6.25%	20.65
3.1%	23.69
1.6%	26.96
0.8%	30.47
0.4%	34.82

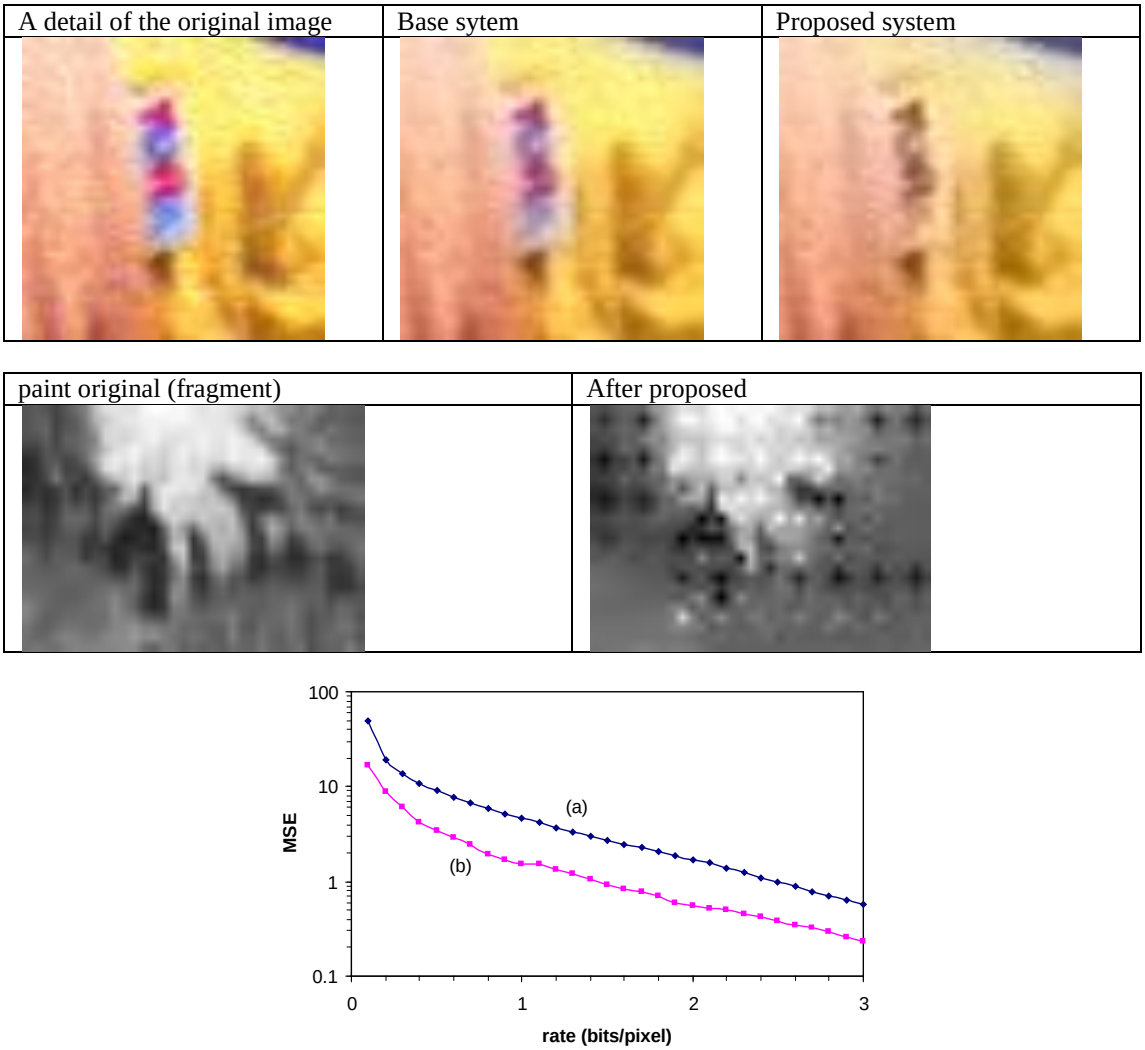


Figure 0-1: Rate Distortion Performance on Transposed Version of coastal_b7 Test Image Using (a) Integer ACO scheme, Fixed-Rate Compression (with UseFill=1), *S*=16, and (b) Float DWT, Full-Frame (*S*=16384) Compression

VI. CONCLUSION

The experiments show that the indicated PLUS wavelet, and the underlying even-odd scheme, is a good candidate for image compression. Wavelet theory also gives an entry point for a smart color transform, usable both for lossy and lossless compression. The conclusion of this paper is therefor that wavelets and image compression go very well together. After these serious conclusions I would like to join some of the results achieved, to give an example of the overall lossy compression that can be achieved on a color image, using the methods described in the paper.
The following treatment seems best:

- Apply the CREW color transform to split the image in three components
- Subsample the chrominance channels twice, to reduce their number of samples to 25 percent
- On the brightness channel, do the wavelet transform 4 times, and slash the detail coefficients of each transform with factors 8, 6, 4 and 2.
- Do a level 2 wavelet transform on the color channels, and slash the details with factors 4, 2.

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