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ARTIFICIAL BEE COLONY OPTIMIZATION BASED COLOR IMAGE COMPRESSION

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Abstract

A new compression technique for color images, which is based on the use of colorization methods, has been proposed. In colorization-based coding, the encoder chooses a few representative pixels (RP) for which the chrominance values and the positions are sent to the decoder, whereas in the decoder, the chrominance values for all the pixels are reconstructed by colorization methods. The main contribution of this project is that formulate the Representative pixel (RP) selection problem into an optimization problem, that is, an L1 minimization problem using an Artificial Bee Colony algorithm has to be used to construct the codebook of vector quantization.The proposed method uses initial of ABC algorithm to develop the VQ algorithm.The Pareto set is used to control the behaviour of the individuals and structuring the bee colony.The selection of the RP is optimal with respect to the given colorization matrix in the sense that the difference error between the original color image and the reconstructed color image becomes minimum with respect to the L2 norm error. Furthermore, the number of pixels in the RP set is also minimized by the L1 minimization. For a fixed error value and a given colorization matrix, the chosen set of RP is the smallest set possible and also propose a method to construct the colorization matrix that colorizes the image in a multiscale manner. This, combined with the proposed RP extraction method, allows us to choose a very small set of RP.

Keywords

Colorization-based coding, Artificial Bee Colony,colorization matrix,RP extraction method.

1. Introduction

In this paper colorization based compression mainly focuses on Representative Pixel(RP) extraction well[1] so that the compression rate and the quality of the restored color image becomes good, which is an essential problem, in many image compression applications.In earlier colorization methods[1]-[4],the encoder selects the pixels required for the colorization process,which are called representative pixels(RP) and maintains the color information only for these RP. The position vectors and the chrominance values are sent to the decoder only for the RP set together with the luminance channel,which is compressed by conventional compression techniques.In image processing, the objective of image compression using colorization is to reduce irrelevance and redundancy of the image data in order to be able to store or transmit data in an efficient form.

Representative Set extraction by using an iterative approach can be defined in the following way. Firstly, preprocessing of image from the original image, for that first the image is resized by using bicubic interpolation method. Interpolation is the process used to estimate an image value at a location in between image pixels. When imresize enlarges an image, the output image contains more pixels than the original image. The image resize function uses interpolation to determine the values for the additional pixels. After resizing, convert the RGB values into YCbCr color space.

In the encoder, the original color image is first decomposed into its luminance channel and its chrominance channels. The luminance channel is compressed using conventional one-channel compression techniques, e.g., JPEG standard, and its discrete Fourier or Wavelet coefficients are sent to the decoder. Then, in the encoder, the colorization matrix C is constructed by performing multi-scale mean shift segmentation on the decompressed luminance channel. The decompressed luminance channel is used to consists with that in the decoder. Using this matrix C and the original chrominance values obtained from the original color image, the RP set is extracted by solving an optimization problem, i.e., an L_1 minimization problem. This RP set is sent to the decoder, where the colorization matrix C is also reconstructed from the decompressed luminance channel. Then, by performing a colorization using the matrix C and the RP set, the color image is reconstructed.

While most colorization based coding methods try to extract the RP set by using an iterative approach, formulate the RP selection problem into an L_1 minimization problem. An essential prerequisite for this is that the colorization matrix has to be determined beforehand and will first explain why the L_1 minimization problem suits the RP selection problem well. Then, propose a method to determine the colorization matrix from the given luminance channel before the RP selection.

2. Related Works

RP set extraction can be used in image processing, color correction and compression for multi-view video, TV images compression and optimizing graphics in firewalls. To understand more about the RP set extraction, it deals with (1) Levin's Colorization Technique[5], (2) Colorization-Based Compression Technique,(3)L1 Minimization Model and (4)JPEG Compression. The earlier compression methods give more importance to priori temporary set of RP and random set of RP selection. Additive RP are extracted from regions where the quality does not satisfy a certain criterion using RP extraction methods.

3. Proposed Description

Most colorization compression techniques try to extract the RP set by using an iterative approach, hence formulate the RP selection problem into an optimization problem. An important content for this,ie construction of the colorization matrix that can be made at first.Then describes how the extraction of the RP set has to be done and checks if the correct RP set can be selected for the restore of the original image using proposed technique.

Overall System diagram

Figure 1 shows the overall system diagram of the proposed method. In the encoder, the original color image is first decomposed into its luminance channel and its chrominance channels. The luminance channel is compressed using conventional one-channel compression techniques, e.g., JPEG standard, and its discrete Fourier or Wavelet coefficients are sent to the decoder. Then, in the encoder, the colorization matrix C is constructed by performing a multi-scale mean shift segmentation on the decompressed luminance channel. The decompressed luminance channel is used to consists with that in the decoder. Using this matrix C and the original chrominance values obtained from the original color image, the RP set is extracted by solving an optimization problem, i.e., an L_1 minimization problem. This RP set is sent to the decoder, where the colorization matrix C is also reconstructed from the decompressed luminance channel. Then, by performing a colorization using the matrix C and the RP set, the color image is reconstructed.

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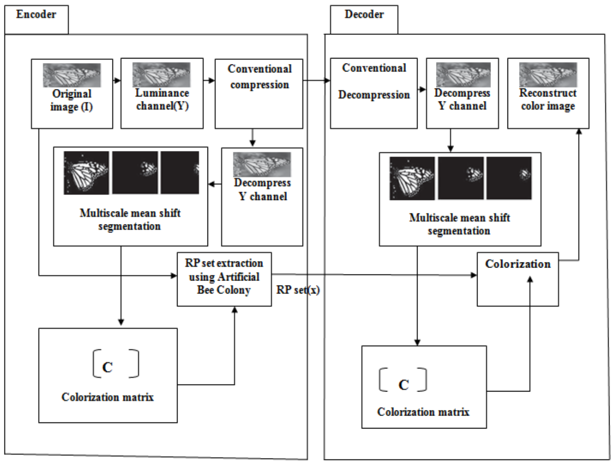

Fig.1: Overall System diagram

Formulating the RP Extraction Problem into an Optimization Problem

The colorization process can be expressed in matrix form as follows:

$$\mathbf{u} = C\mathbf{x} \quad (1.1)$$

Here, C represents the matrix which performs a colorization process on x to obtain the colorized image u. Here, u is a one dimensional vector of size n, representing the image in raster scan order which has n pixels. The Levin's colorization method can be expressed with $C = A^{-1}$, where C is a square matrix of size $n \times n$. In the proposed method, C has the size $n \times m$, where m is the size of x, and normally $m < n$. Other colorization methods can also be expressed using different C matrices.

After the colorization construction and chrominance from the original image then goes to the verification of the RP set extraction.Codebook of vector quantization uses Artificial Bee colony algorithm[7]-[11] for this process checking and works the quantization algorithm on it.After that Pareto set can be used to construct the behaviour of RP sets and construct according to the colony.Next explain how the artificial bee colony works.Artifical bee colony,an optimization algorithm based on the intelligent foraging behaviour of honey bee spam and gets new solution by searching the neighbourhood of the current solution in the search process and the scope searched is small,which leads to slow convergence and easily gets stuck to the local optimal solution.

Table 1:Artificial Bee Colony Algorithm

Artificial Bee Colony Algorithm
1.Load training Samples 2.Generate the initial RP combination z_i,i=1…….SN 3.Evaluate the fitness(fi) of the RP combination 4.Set cycle to 1 5.Repeat 6.For each employed bee{ Produce new solution v_i by using (6) Calculate the value fi Apply greedy selection process

```
                        }
7.Calculate the probability values Pi for the
solutions(zi).
8. For each onlooker bee{
                        Select a solution zi
              depending on Pi
                        Produce new solution vi
                        by using (6)
                        Calculate the value fi
                        Apply greedy selection
                         process
                        }
9.If there is an abandoned solution for the scout then
   replace it with a new solution which will be
  randomly produced by (7)
10.Minimize the best solution so far.
11.cycle=cycle+1 until cycle=MCN
```

Performance evaluation:

Compression framework uses for increasing the potential performance i.e. the quality and compression of the reconstructed color image, varies the method a little, by putting some extra small-scaled wavelet basis vectors in the colorization matrix C, together with the basis vectors generated by the mean shift segmentation. This does not increase the file size of the encoded image, due to the fact that wavelet basis vectors can be generated without the knowledge about the image. The chances that the L_2 difference error reduces are now increased, since C contains more column vectors, and will choose the optimal linear combination of the column vectors with respect to the L_2 difference error. Therefore, the PSNR values increases and surpasses the performance of the JPEG2000 as can be seen, where denote the modified proposed method by proposed 2'.

4. Analysis

In RP set extraction to an optimal solution, extract a few representative or redundant pixels from the original image and perform colorization and restore the image as just like the earlier image using Artificial Bee Colony techniques.This RP set can be stored in a codebook of vector quantization with the help of VQ algorithm.If VQ algorithm works in a proper way,then goes to the Pareto set.The Pareto set again rechecks the behaviour of the color combinations and structured the code book according to it. After that the encoder RP set selction moves to the decoder process.If the redundant pixel cannot satisfy the above operations in encoder,it again go for the rechecking of construction code book.

5. Conclusion

In this, formulating the colorization based coding problem into an optimization problem with the help of a new proposed technique.By formulating the problem as an optimization problem there have opened the way as code book of vector quantizatio to tackle the colorization based coding problem using several well-known colorization techniques. Furthermore, with the help of a method to compute the colorization matrix which can colorize the image with a very small set of RP. Experimental results show that the proposed method surpasses other colorization based coding methods to a large extent in quantitative as well as qualitative measures. The proposed method also surpasses the JPEG standard, and is comparable to the JPEG 2000 standard.

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