IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology
ISO 3297:2007 Certified
Vol. 3, Issue 7, July 2016

Image Retrieval System using Evolutionary Based Optimization Algorithm

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Abstract: Image retrieval is a way of recognizing pre-defined template patterns in the reference images. This technique has been developed rapidly over the past few decades and its applications have been extended to the fields such as face recognition, pulmonary nodules detection, handwriting identification and road detection. Image retrieval is a fundamental issue in pattern recognition. In this work, lateral inhibition (LI) model is adopted as a pre-processing step, which widens the gray level gradients so as to facilitate the subsequent image retrieval scheme. Regarding the search process for perfect geometric transformations that yield a perfect match between the test image and the predefined template, we consider utilizing meta heuristic algorithms, aiming to efficiently promote the probability to obtain global optimums. The artificial bee colony (ABC) algorithm is a bio-inspired optimization technique, which assimilates the foraging behavior of honey bee swarms. It is well known that the algorithm is good at exploration but poor at exploitation. ABC is a swarm intelligence algorithm inspired by the forging behavior of bees. In this algorithm, the employed bees, the onlooker bees, and the scout bees cooperate to search for the optimal nectar source in the space. We present a balance-evolution artificial bee colony (BE-ABC) algorithm that aims to strike a balance between exploration and exploitation rather than just focusing on improving the latter. This BE-ABC algorithm utilizes convergence information during the optimization process to Manipulate its search intensity in the exploration and exploitation phases. Besides that, it incorporates an overall degradation procedure for generating scout bees so as to efficiently prevent premature convergence. Experimental results confirm that BE-ABC algorithm is more capable than several state-of-the-art intelligent algorithms in this LI-based image retrieval scheme. Besides, investigations are also made on the advantages and limitations of this LI model.

Keywords: pulmonary nodules detection, handwriting identification and road detection, balance-evolution artificial bee colony (BE-ABC) algorithm.

1. INTRODUCTION

Image retrieval is a way of recognizing pre-defined template patterns in the reference images. This technique has been developed rapidly over the past few decades and its applications have been extended to the fields such as face recognition, pulmonary nodules detection, hand writing identification and road detection. The phenomenon of lateral inhibition (LI) was first discovered in 1932 during an Electrophysiology experiment on the limulus' vision. It has been extensively developed and Investigated in the field of computer vision since then. When processed by the LI model edges of an original image will be stabilized.

Such feature in LI model provides an underlying settlement to the illumination disturbances that a reference image may involve. Introduced LI in image retrieval schemes, but their works covered none analyses or discussions concerning the necessity or limitations of such LI model. In this work, theoretical analyses are originally released to investigate the advantages/ disadvantages of introducing LI into the image retrieval scheme. With regard to the searching strategies that help to find the best-matching location proposed a thorough search algorithm, in which all the pixel-candidate positions are checked until the one with the maximum similarity is located. Due to its exhaustive search, the thorough search algorithm has very limited applications, especially in some real-time recognition issues. Artificial bee colony (ABC) is a swarm intelligence algorithm inspired by the foraging behavior of honey bees. In this algorithm, the bee swarm mainly consists of three components, namely the employed bees, onlooker bees, and scout bees. After the initialization procedure, employed bees will first carry out the global exploration.

Those "qualified" employed bees will then attract onlooker bees to follow them. Here, to follow means to search locally around the position of a qualified employed bee. Based on the roulette selection strategy typically used in ABC, the relative qualification of each employed bee will determine the corresponding probability of it being followed by onlooker bees. Over the search process, unqualified employed bees will perish and randomly initialized scout bees will take their places. Various studies using different numerical benchmark tests have confirmed that the ABC algorithm possesses competitive advantages

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comparing to some other well-known evolutionary algorithms. Besides that, the algorithm framework of ABC is relatively simple, making it possible to acquire good results at a low computational cost. This gives rise to applications of ABC spanning across diverse areas such as shape recognition, economic load dispatch, structure optimization, machine learning, route programming, among many others.

To the best of our knowledge, however, little attention has been paid to utilizing convergence information from within the framework of the algorithm.

In other words, we believe that convergence information from a previous cycle of iteration can be used as feedback to guide the search procedure in a subsequent iteration. In contrast to the many hybridized and exploitation-focused ABC algorithms from the relevant literature, here we systematically analyze the idea of using convergence information to balance both exploration and exploitation during the optimization process.

The balance-evolution artificial bee colony (BE-ABC) algorithm presented in this paper differs from other ABC algorithms in that it utilizes an invalid trial time counter parameter within the algorithm framework to determine the exploration/exploitation accuracy, and to manipulate the generation of scout bees according to an overall degradation rule.

Ideally, we hope to see no explicit distinctions between the exploration or exploitation process. That is, when the global search scale is small, the search process can resemble a local search; and when the local search scale is large, it can essentially become a global search.

In this sense, the search intensity is guided and, to a great extent, conformed to true needs. BE-ABC algorithm is applied for the image retrieval optimization.

2. EXISTING METHOD

The phenomenon of LI was first discovered by Hartline and Graham in 1932, during an electrophysiology experiment on limulus vision. They verified that each ommateum of a limulus was inhibited by its neighboring ommatea, and the nearer they were, the stronger the inhibited effect would be. Such inhibited effect is mutual and spatially summed.

In this way, the light and shade contrast in the sense of vision is enhanced. With regard to the mechanism of retinal imaging, some further research has confirmed that, excited retinal ganglion cells inhibit those non excited ones more strongly than the non excited retinal ganglion cells to the excited ones.

In this work, LI model is applied to the image retrieval scheme as a pre-processing procedure in order to promote matching accuracy.

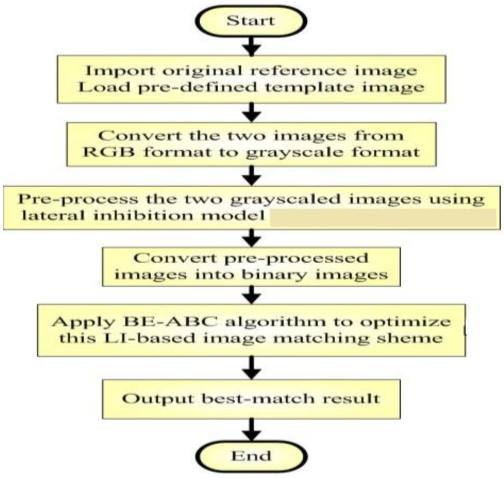

Fig 2.1: Block Diagram for Existing Method

The phenomenon of lateral inhibition (LI) was first discovered in 1932 during an Electrophysiology experiment on the limulus' vision. It has been extensively developed and Investigated in the field of computer vision since then. When processed by the LI model edges of an original image will be stabilized. Such feature in LI model provides an underlying settlement to the illumination disturbances that a reference image may involve. Introduced LI in image retrieval schemes, but their works covered none analyses or discussions concerning the necessity or limitations of such LI model. In this work, theoretical analyses are originally released to investigate the advantages/ disadvantages of introducing LI into the image retrieval scheme. The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors. RGB is a device-dependent color model: different devices detect or reproduce a given RGB value differently, since the color elements and their response to the individual R, G, and B levels vary from manufacturer to manufacturer, or even in the same device over time. Thus an RGB value does not define the same color across devices without some kind of color management. Grayscale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelength. Finally image is appear.

3. PROPOSED METHOD

ABC is a swarm intelligence algorithm inspired by the forging behavior of bees. In this algorithm, the employed bees, the onlooker bees, and the scout bees cooperate to search for the optimal nectar source in the space.

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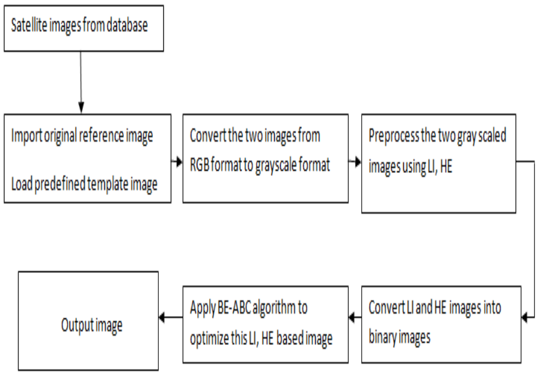

Fig 3.1: Block diagram for proposed method

Satellite images from database are acquired, then import original reference image and loaded with predefined template image. Template image appears in form of two to ten pixels formation. Images are converted from RGB format to grayscale. The processing of the gray scale images is done using lateral inhibition and histogram equalization methods. Histogram equalization is a method in image processing of contrast adjustment using the image histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In particular, the method can lead to better views of bone structure in x-ray images, and to better detail in photographs that are over or under-exposed.

4. ALGORITHM FOR PROPOSED METHOD

Step 1: Set the population size SN, maximum cycle number MCN; set the invalid trail time counter trial (i)=1,2,…SN/2.
Step2: Randomly initialize locations of SN/2 scout bees.
Step3: For iter =1 to MCN; do
Step4: For item =1 to SN/2, do % the employed bee phase.
Step5: Randomly generate as many as trial (item) different integers from 1 to D and collect them in a set.
Ste 6: Then implement the greedy selection if set trial (item)←1.
Step7: Else, trial (item)←trial(item)+1;
Step8: For i= 1 to SN/2, do % prepare for the roulette selection.
Step9: Choose the jth employed bee to follow, and generate location to the onlooker bee.
Step10: Else, trial (j)←1;
Step11: Set their corresponding scalars.
Step12: End if
Step13: Memorize the best solution.
Step14: End for
Step 15: output the best solution

5. RESULTS

Original image:

Fig 4.1: original image

An image is acquired from satellite which is shown in above image. This satellite image is original image in this project. Im load original reference image, then load predefined template image. Template makes an image into two to ten pixels. This template image which is compared to the honey comb, gives quality of an image. For this original image, implementation of RGB to gray scale conversion is implement in first stage.

RGB to Gray Scale Image:

The RGB to gray scale image conversion image is shown with RGB to gray scale image. The original image conversion takes place in to the gray scale image. The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions

Fig 4.2: RGB to gray scale image

And computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors. RGB is a device-dependent color model: different devices detect or reproduce a given RGB value differently, since the color elements and their response to the individual R, G, and B levels vary from manufacturer to manufacturer, or even in the same device over time. Thus an RGB value does not define the same color across devices without some kind of color management. Grayscale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelength. Finaly image is appear.

DOI 10.17148/IARJSET.2016.3704

Preprocessing LI image:

Fig 4.3: Preprocessing image

Artificial bee colony (ABC) is a swarm intelligence algorithm inspired by the foraging behavior of honey bees. In this algorithm, the bee swarm mainly consists of three components, namely the employed bees, onlooker bees, and scout bees. After the initialization procedure, employed bees will first carry out the global exploration. Those “qualified” employed bees will then attract onlooker bees to follow them. Here, to follow means to search locally around the position of a qualified employed bee. Based on the roulette selection strategy typically used in ABC, the relative qualification of each employed bee will determine the corresponding probability of it being followed by onlooker bees. Over the search process, unqualified employed bees will perish and randomly initialized scout bees will take their places. Various studies using different numerical benchmark tests have confirmed that the ABC algorithm possesses competitive advantages comparing to some other well-known evolutionary algorithms. Besides that, the algorithm framework of ABC is relatively simple, making it possible to acquire good results at a low computational cost. This gives rise to applications of ABC spanning across diverse areas such as shape recognition, economic load dispatch, structure optimization, machine learning, route programming, among many others.

LI and HE image:

Fig 4.4: LI and HE image

Histogram equalization is a straight forward image-processing technique often used to achieve better quality images in black and white color scales in satellite images. All these images require high definition and contrast of colors to determine the pathology that is being observed and reach a diagnosis. However, in some type of images histogram equalization can show noise hidden in the image after the processing is done. This is why it is often used with other imaging processing techniques. In our application, Histogram Equalization method is used to extracted roads and Buildings for gray images.

Fig 4.5: BEABC image

The processing of the gray scale images is done using lateral inhibition and histogram equalization methods. Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In particular, the method can lead to better views of bone structure in x-ray images, and to better detail in photographs that are over or under-exposed.

6. COMPARISION TABLE WITH PARAMETERS:

PARAMETERS	LI WITH ABC	LI AND HE WITH ABC
1.Background	81	114
2.Standard Deviation	67.641794	76.690497
3.Average intensities	92.676341	118.24403
4.Sum of intensities	42322134	53830833

Table 4.1: Parameters

LI = LATERAL INHIBITION
HE =HISTOGRAM EQUALIZATION
ABC = ARTIFICIAL BEE COLONY

7. CONCLUSION AND FUTURE SCOPE

Satellite images from database are acquired, then import original reference image and loaded with predefined template image. Template image appears in the form of 2 to 10 pixels formation. Images are converted from RGB format to grayscale. The processing of the gray scale images is done using lateral inhibition and histogram equalization methods with artificial bee colony. Histogram equalization isamethodin imageprocessing of contrast adju stment using the image's histogram. We obtained the best output results using existing preprocessing method Lateral Inhibition with Histogram equalization methods and ABC optimization method. The proposed Methods are also applicable for the Real Time applications in future for different fields i.e., tsunami identification, Military areas etc, for both Gray Scale Images and color Images.

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