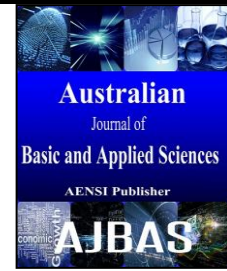




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A Study of Various Issues and Enhancement Technique on ACO in Image Processing

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ABSTRACT

Image processing is defined as a technique of analysing and manipulating an image, in order to provide or to obtain a very good quality of it. The application of image is diverse and unique in various areas. Some factors which determine the quality of image are compression for storage, enhancement and perfect visualisation for observers. In this paper, some of the hurdles or issues in processing an image are discussed below.

Keywords:

Image processing, quality, issues.

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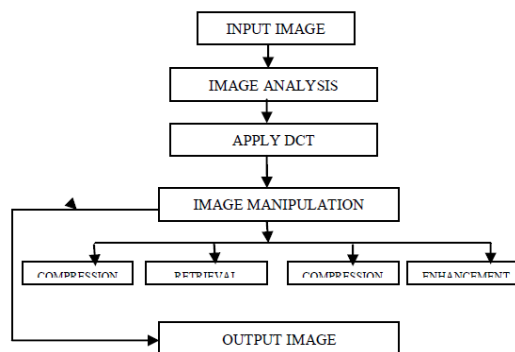
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INTRODUCTION

Image processing is conversion of an image in to digital image using some mathematical operations for perfection of quality. Digitized image should be capable of compression, enhancement, storage of image, retrieval of image, visualization of objects, differentiation of invisible object .Image can be of

analog or digital but the goal is to obtain the undistorted image. Getting a very clear image or picture in any form is a very tedious job. Removal Of unwanted information in an image is the first job to be done to make it clear. Removal of noise is done by various steps of filtering and pre-processing image.

Steps in Image Processing:



2. Organisation of the paper:

In this paper, first part deals with general issues in image processing and the second part deals with the one of the image enhancement technique of Ant Colony Optimization (ACO)

Third part deals with the thresholding technique of OTSU algorithm. Fourth is the Result and fifth is the conclusion and future scope of the project.

3. Outstanding Issues In Image Processing:

Some of the major problems in processing of image and its possible solutions are listed below.

A) Noise:

Noise is due to the variation of image density which appears as grains due to pixel level Variations in an image.

B) Dynamic range:

It is similar to noise where it deals with the range of exposure of object to the light.

C) Sharpness:

It deals with the exactness of an picture that can be conveyed. It depends on the quality factors of lens and camera.

**D) Distortion:**

Distortion is the appearance of the straight lines over the curves. It is a kind of irregular Image.

E) Vignetting:

It is a kind of giving very dark images for an object.

F) Lens Flare:

It is a kind of problem of producing ghost look for an image due to bad lens quality.

G) Brightness:

Object should be bright enough to be viewed by the observer. Dark look will give a bad feel.

H) Accuracy:

Perfect image with good feel and no noise and no distortion in image is accurate.

I) Compression:

It is necessary to compress a image for certain applications like video conferencing Where it needs only kilobits of data per second. Whereas television data needs a video Stream of data in megabyte. So, compressing data from big to small is a challenging task.

J) Enhancement:

In order to achieve or improve the quality of the blurred image it should be enhanced in such a way without any noise and distortion. Particularly quality should be enhanced in the edges and margin of the object.

L) Recognition:

Recognition an unknown input pattern of object which is specified in the pre-defined classes is an tedious task if the object declared in the classes is not

present and it is supposed to be an generic object like table, chairs ,electronic items etc..

M) Visualization:

Visualization is an another difficult task for perfect image capture because it is very tedious for non-rigid object like hair, clouds, waves etc.

N) Low bit rate:

Low bit rate is the digital broadcasting application for television purposes. Achieving a good quality pictures by low bit rate signals is a very tedious task. Some of the techniques for low bit rate processing is by

- Model based images
- Synthesis of facial expressions
- Analysis of facial motions

Though several issues arises in image processing. Each and everything is overcome by different algorithms and methodologies.

The following part of this paper deals with the image enhancement using the Ant Colony Optimization (ACO).

4. Ant Colony Optimization:

Ant colony optimization algorithm (ACO) is a probabilistic technique for solving computational problems which can be reduced to finding good paths through graphs.

Ant Colony Optimization is used in image processing method for edge detection and edge linking algorithm.

Steps involved in edge detection process are as follows:

1. Pheromone Matrix is formed based on the pixel position of the ant movement.

Determining the matrix is a difficult task. For the below example the heuristic matrix was calculated

based on the local statistics: the local statistics at the pixel position (i,j).

$$\eta_{(i,j)} = \frac{1}{z} * v_c * I_{(i,j)} \quad (1)$$

Where is the image of size of M1*M2

$$z = \sum_{i=1}^{M1} \sum_{j=1}^{M2} v_c(I_{i,j}) \quad (2)$$

This is a normalization factor

$$v_c(I_{i,j}) = \sqrt{(|I_{(i-2,j-1)} - I_{(i-2,j-1)}| + |I_{(i-2,j-1)} - I_{(i-2,j+1)}| + |I_{(i-1,j-2)} - I_{(i-1,j-2)}| + |I_{(i-1,j-1)} - I_{(i-1,j-1)}| + |I_{(i-1,j-1)} - I_{(i-1,j+1)}| + |I_{(i-1,j)} - I_{(i-1,j)}| + |I_{(i-1,j-1)} - I_{(i-1,j-1)}| + |I_{(i-1,j-2)} - I_{(i-1,j-2)}| + |I_{(i-1,j-1)} - I_{(i-1,j-1)}|)} \quad (3)$$

f(.) Can be calculated using the following functions:

$$f(x) = \lambda x, \text{ for } x \geq 0; \quad (4)$$

$$f(x) = \lambda x^2, \text{ for } x \geq 0; \quad (5)$$

$$f(x) = \begin{cases} \sin\left(\frac{\pi x}{2\lambda}\right), & \text{for } 0 \leq x \leq \lambda \\ 0, & \text{else} \end{cases} \quad (6)$$

$$f(x) = \begin{cases} \pi \sin\left(\frac{\pi x}{2\lambda}\right), & \text{for } 0 \leq x \leq \lambda \\ 0, & \text{else} \end{cases} \quad (7)$$

The parameter λ in each of above functions adjusts the functions' respective shapes.

2. Intensity of the pixel position is calculated.
3. Ant movement is calculated by connecting 4 or 8 pixels.
4. Trail of the ant and the evaporation rate of the ant are updated twice using the function

$$\tau_{new} \leftarrow (1 - \psi)\tau_{old} + \psi\tau_0, \quad (8)$$

Where ψ is the pheromone decay co-efficient
 $0 < \tau < 1$

5. Once the ant has moved to certain distance whether it is an edge or not is determined by the method of the thresholding technique OTSU algorithm.

5. Otsu algorithm:

OTSU algorithm is a global thresholding method. It is calculated by the total mean and variance.

Pixel is divided in to 2 classes with C1 and C2

C1: P1/W1(t).....P1/W1(t)

C2: Pt+1/W2(t).....PL/W2(t)

Based on the 2 classes mean and variance is Calculated.

The "mean" is the "average" you're used to, where you add up all the numbers and then divide by the number of numbers. The variance measures how far each number in the set is from the mean. Variance is calculated by taking the differences between each number in the set and the mean, squaring the differences (to make them positive) and dividing the sum of the squares by the number of values in the set.

Mean and variance gives the intensity of the images which are equal. Unequal intensity will not give good result for images.

ACO can be applied even to 2 image enhancement types like gray scale image and coloured images.

6. Result:

Quality is an important factor for an image hence it is acquired through ant colony optimization and OTSU algorithm. Using this technique result is found to me better. But the thresholding technique of OTSU can give the better result only if it has an equal intensity of pixel. But, if there is any variation in the pixel intensity result will be not as expected.

7. Conclusion And Future Scope:

From the above discussion it is very much clear that Image processing is used to extract the information from the images. Here, to bring out the enhancement optimisation technique of ant colony is used. Further improvement can be done with the other optimisation techniques for best results.

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