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A Survey of Image Processing and Two Dimension Image Recognition

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ABSTRACT
Computer Vision and Image processing is continually growing. During the past ten years, there has been a significant increase in the level of interest in computer vision, image recognition, soft computing techniques, neural networks etc. This paper reviews different research papers on Digital image, fundamental of digital image processing. Lastly, it focuses on the future scope of the image recognition.

Keywords: Image Recognition, Neural Network, Fuzzy Logic, Genetic Algorithm, Soft Computing.

INTRODUCTION:

Digital Image recognition is the ability of a system or software to identify objects, people, places, and actions in images. It uses machine vision technologies with artificial intelligence and trained algorithms to recognize images through a camera system.

Two dimension digital image is represented as an array of real or complex numbers represented by a definite number of bits. An digital Image is represented as a two dimensional function $f(x,y)$, where 'x' and 'y' are spatial (plane) coordinates and the amplitude of f at any pair of co-ordinates (x,y) represents the intensity or gray level of the image at that point. The digital image is one for which both the co-ordinates and the amplitude value of f are all finite, discrete quantities. Hence, a digital image is composed of a finite number of elements, each of which has a particular location value. These elements are called image elements, picture elements or pixels.

A digital image is discrete in both spatial coordinates and brightness and it can be considered as a matrix whose rows and column indices identify a point on the image and the corresponding matrix element value identifies the gray level at that point.

There are many sensors or devices to acquire images. Most of the device or sensors give a continuous voltage as output, which will be continuous in both amplitude and coordinates. To convert it a digital form, we have to sample this function in both co-ordinates and amplitude. Digitizing the co-ordinate values is called sampling. Digitizing the amplitude value is called quantization. The of sampling and quantization is a matrix of real number.Hence , an image can be represented as shown in figure 1.

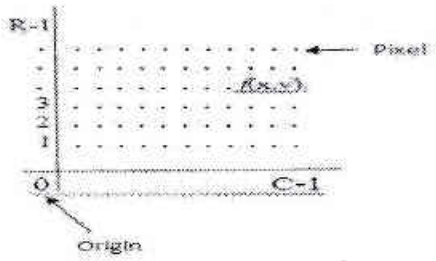

Figure 1

Image Representation

Where the function $f(x,y)$ is assumed to have 'R' rows and 'C' columns. The values of the coordinates are now discrete quantities.

Now, from the above notation, we can write the function $f(x,y)$ as shown in the below

$$f(x,x) = \begin{pmatrix} f(0,0) & f(0,1) & \cdots & f(1,C-1) \\ f(1,0) & f(1,1) & \cdots & f(1,C-1) \\ \vdots & & & \\ f(R-1,0) & f(R-1,1) & \cdots & f(R-1,C-1) \end{pmatrix}$$

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And the above matrix notation, can be modified as,

$$P = \begin{pmatrix} P_{0,0} & P_{0,1} \ldots \ldots & P_{0,C-1} \\ P_{1,0} & P_{1,1} \ldots \ldots & P_{1,C-1} \\ \cdot & & \\ \cdot & & \\ \cdot & & \\ P_{R-1,0} & P_{R-1,1} \ldots \ldots & P_{R-1,C-1} \end{pmatrix}$$

Where $P_{x1} = f(x=i,y=j) = f(i,j)$

LITERATURE REVIEW

Today, in the 2022th, we are heading into new era of ubiquity, where the user of the internet are counted in trillions and where humans may become the minority as generators and receivers traffic. Instead, most of the traffic will flow between devices and all kinds of "things", thereby creating a much wider and more complex digital image.

It focuses on the recognition of MRF image and FFNN is used to solve the two basic problems of MRF modeling. He uses clean and noisy binary images. The Recognition rate is 100% using Gibbs and Noise Parameters [1].It proposed an EBAM i.e. extended bidirectional associative memory (EBAM) neural network model and MLP NN. He used gray image. In pre-processing filtering, enhancing the image and removing the noise of image, extracting the feature of image and applying EBAM model. The Recognition rate is EBAM is better than MLP NN [2]. It focuses on FL, GA and NN approach. He used NN approach for nature scene image segmentation. The result show nature scene image segmentation efficiency is good using NN approach [3]. The concept of different Edge detection method is focused. The experiment use Noiseless and Noise images [4]. This paper is focused on segmented image using soft computing techniques [5].It is very difficult to recognition degraded image. Outdoor image scenes are degraded due to cloudy medium in the atmosphere (i.e., impurity in air). Such as lack of clarity, fog, and pollution are the phenomena of atmospheric absorption that scatter the image. It focuses on Various Image Dehazing Techniques to remove noise and recognize it [6]. This paper used "LIVE Image Quality Assessment Database", university of Texas. It uses MATLAB to convert colour image to gray scale image. He compares the original and mutilated images using (PSNR), HVS utilizing Fourier Transform, Structural Similarity Index (SSIM), and Universal Image Quality Index (UIQI) measurements. TheComparison result display in tabular format [7].Three Alex Nets, GoogLeNet and ResNet50network are used. CIFAR10,CIFAR100 and MNIST data sets are used. Object detection and object category classification using CNNs. GoogLeNet and ResNet50 network to recognize improved accuracy objects compared to Alex Nets. Performance of CIFAR10 test dataset and CIFAR100 test dataset show in tabular format [8].It focuses on image recognition system structure. The image set of COIL20 is used. Traditional and Improved BP neural network is used to for object recognition and comparison result is shown [9].

Fundamental steps in Digital Image Processing [10]:

Figure bellow shows fundamental steps in digital image processing.

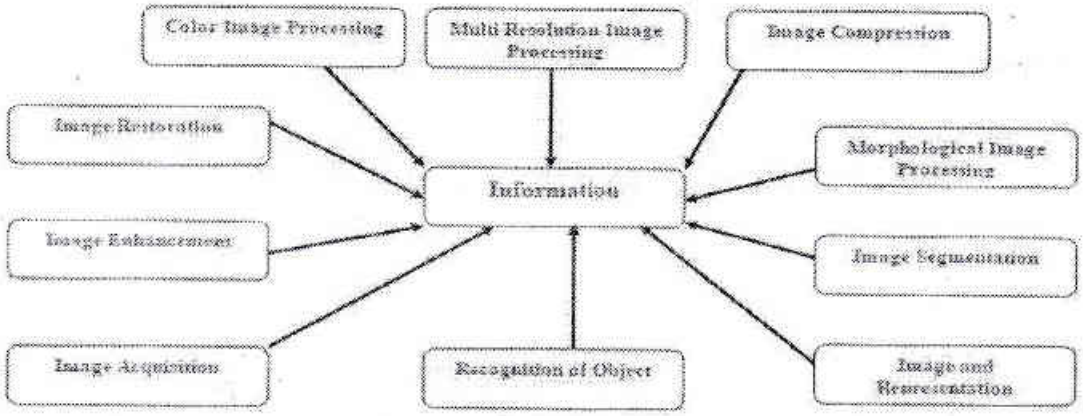

Figure 2

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FUNDAMENTAL STEPS IN DIGITAL IMAGE PROCESSING

These steps are briefly discussed bellow.

1. Image Acquisition

This is the first step and fundamental step of digital image processing. Image acquisition could be as simple as being given an image that is already in digital form. Main task performed in the Image acquisition step is pre-processing such as scaling etc.

2. Image Enhancement

Image enhancement is among the simplest and most tempting area of digital image processing. Basic idea behind enhancement techniques is to bring out detail that is disguised, or simply to highlight certain features of significance in an image such as changing brightness & contrast of the image etc.

3. Image Restoration

Improving the appearance of an image is achieved by Image restoration. However, unlike enhancement, which is subjective, image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of image degradation.

4. Color Image Processing

Color image processing is an area that has been gaining its importance because of the significant increase in the use of digital images over the Internet. It includes color modelling and processing in a digital domain etc.

5.Multi Resolution Image Processing

Multi Resolution offers an capable outline for extracting information from images at various levels of resolution.

6. Image Compression

Image Compression deals with technique for reducing the storage size required to save an image or the bandwidth to transmit it. Particularly data compression is very significant in the data transmission through internet.

7. Morphological Image Processing

Morphological Image processing deals with tools for extracting image components that are useful in the representation and description of shape.

8. Segmentation

Segmentation partitions an image into its ingredient parts or objects. Autonomous segmentation is one of the most difficult tasks in digital image processing. A rugged segmentation procedure brings the process a long way toward successful solution of imaging problems that require objects to be identified individually.

9. Image and Representation

Image and Representation almost always follow the output of a segmentation stage, which usually is raw pixel data, constituting either the boundary of a region or all the points in the region itself. Choosing a representation is only part of the solution for transforming raw data into a form suitable for subsequent computer processing. Image deals with extracting attributes that result in some quantitative information of interest or are basic for differentiating one class of objects from another.

10. Recognition of Object

Recognition is the process that assigns a label, such as, "motor vehicle" to an object based on its descriptors.

11. Information:

Information may be as simple as detailing regions of an image where the information of interest is known to be located, thus limiting the search that has to be conducted in seeking that information. The Information base also can be quite complex, such as an interrelated list of all major possible defects in a materials inspection problem or an image database containing high-resolution satellite images of a region in connection with change-detection application

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Future scope of image recognition Two and Three dimensional digital image recognition has a large scope in the future research. It will help to monitor the different two and three dimension image. Unpredictable development might be occurring using soft computing. It will also help with recognize different category of image. It is useful to convenient to computer security, human security etc.

Conclusion It is our opinion that research on the image recognition is an exciting area for many year to come and will keep many scientists and engineers, researcher busy. This paper introduces Digital image and fundamental of digital image processing. It studied so many different techniques for image recognition. Lastly, it focuses on the future direction of the image recognition & the topic is open to further research.

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