Review of Image Processing & Pattern Recognition along with Sampling & Quantization

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Abstract

This paper explores an overview analysis of recently existing sampling quantization & pattern recognition process for image processing .In this technique we create an image which is in analog form. So we need to convert continuous data into digital form using sampling and quantization.The identification or interpretation of the pattern in a picture will be represented effectively with the help of Pattern Recognition (PR). It aims to extract data concerning the image to classify its contents. Pattern recognition is that the analysis space that studies the operation and style of systems that acknowledge patterns in information. In this work 3 basic approaches of pattern recognition are analyzed: statistical pattern recognition, structural pattern recognition and neural pattern recognition. Recent works involve within the study of Pattern recognition ways on texture classifications.

Keywords- *Sampling, Quantization, Resolution, Pixel, Amplitude, Spatial resolution, Grey level.*

1. INTRODUCTION

The output of most image sensor is analogue Signals and we cannot apply digital processing on it because it requires internet memory to store a signal that can have infinite values so we have to convert an analogue signal into a digital signal.

Basic terms for understanding sampling and quantization

Resolution:- How many number of element that picture contain is known as resolution.

Pixel:- The element in a picture is known as pixel it is smallestpartof an image.

Grey level:-It is a value of pixel it's value is {0,1,2.............}
Image:- Image is a collection of pixel and pixel have some finite grey level.

Spatial resolution:-spatial resolution is the number of pixel used to construct the image.[10]

TYPES OF IMAGES:-

1) **Binary Image (0,1):-** In binary image the value of grey level of pixel is only 0 and 1.

Fig.1.1(a) Binary Image Coded

Fig.1.1(b) Binary Image Decoded

2) **Colour Image:-** In colour image the value of grey level of pixel i[illegible] RGB colour means (Red, Green, Blue).

Fig.1.2(a) Color Image

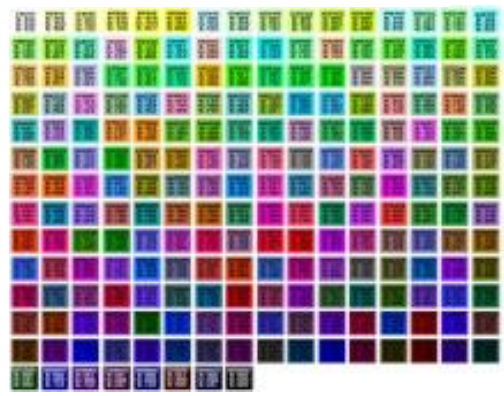

Fig.1.2(b) Pixel Form of Color Image

3) **Grey Image:-** Grey image contain 8bit grey value for one element or pixel.[11]

Fig.1.3 Grey Image

2.PATTERN RECOGNITION

At the age of 5, most children can recognize letters & digits. Small characters, large characters are easily recognized by young. The character may be written on a ambiguous background, on a crushed paper. We take this ability for granted until we face the task of teaching a machine how to do the same work. Pattern recognition is the study of how machines can observe the environment, learn to find the patterns of interest from their background & make proper decision about the categories of the pattern.

2.1WHAT IS PATTERN RECOGNITION?

Machine recognition, description & grouping of patterns are important problems in a variety of engineering & scientific work such as biology, psychology, medicine, marketing, artificial intelligence & remote sensing, But what is pattern ?[12].

Watanabe defines a pattern "as opposite of a chaos; it is an entity, vaguely defined, that could be given a name." For example, a fingerprint image, a handwritten text, a human face etc. can be a pattern.

2.2 METHODS OF PATTERN RECOGNITION

A. STATISTICAL PATTERN RECOGNITION:-

Statistical Pattern Recognition is a classical method of Pattern Recognition. In this Pattern Recognition a pattern is represented by a set of d-features or attributes, viewed as a d-dimensional feature vector. The concept from statistical decision theory is utilized to establish decision boundaries in pattern classes. It is operated in 2 modes: training (learning) & classification (testing). In training mode, the feature extraction module finds the appropriate features for representing the input patterns & the classification is trained to partition the feature space. In classification mode, the trained classifier assigns the input pattern any class under consideration based on the measured feature.

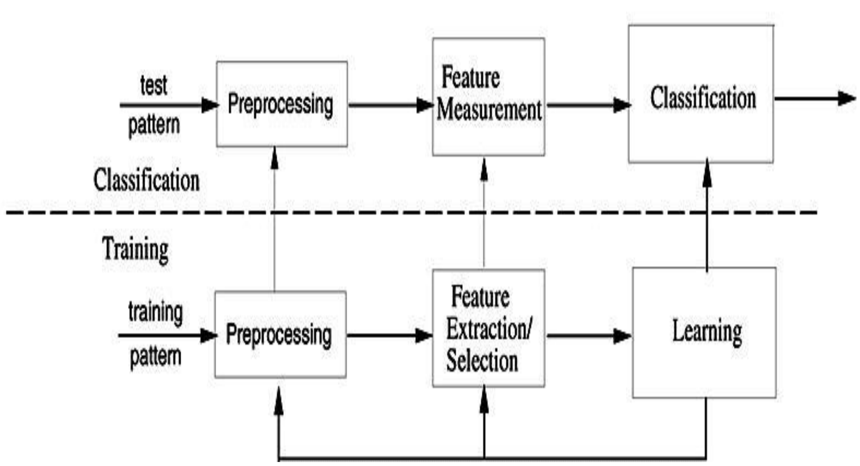

Fig.2.2(a) Statistical Pattern Recognition

B. STRUCTURAL PATTERN RECOGNITION METHOD

Structural Pattern Recognition[1][2][3], sometimes referred to as syntactic pattern recognition due to its origins in formal language theory, relies on syntactic grammars to discriminate among data from different groups based upon the morphological interrelationships (or interconnections) present within the data. Structural pattern recognition systems have proven to be effective for data which contain an inherent, identifiable organization such as image data (which is organized by location within a visual rendering) and time series data (which is organized by time). The usefulness of structural pattern recognition systems, however, is limited as a consequence of fundamental complications associated with the implementation of the description and classification tasks.

The description task of a structural pattern recognition system is difficult to implement because there is no general solution for extracting structural features, commonly called primitives, from data. The lack of a general approach for extracting primitives puts designers of structural pattern recognition systems in an awkward position: feature extractors are necessary to identify primitives in the data, and yet there is no established methodology for deciding which primitives to extract. The result is that feature extractors for structural pattern recognition systems are developed to extract either the simplest and most generic primitives possible, or the domain and application specific primitives that best support the subsequent classification task. Some structural pattern recognition systems justify the use of a particular set of feature extractors by claiming that the same set had been used successfully by a previous system developed for a similar application within the same domain; such claims simply shift the burden of feature extractor development onto previously implemented systems.

Simplistic primitives are domain independent, but capture a minimum of structural information and postpone deeper interpretation until the classification step. At the other extreme, domain and application specific primitives can be developed with the assistance of a domain expert, but obtaining and formalizing knowledge from a domain expert, called knowledge acquisition, can be problematic.

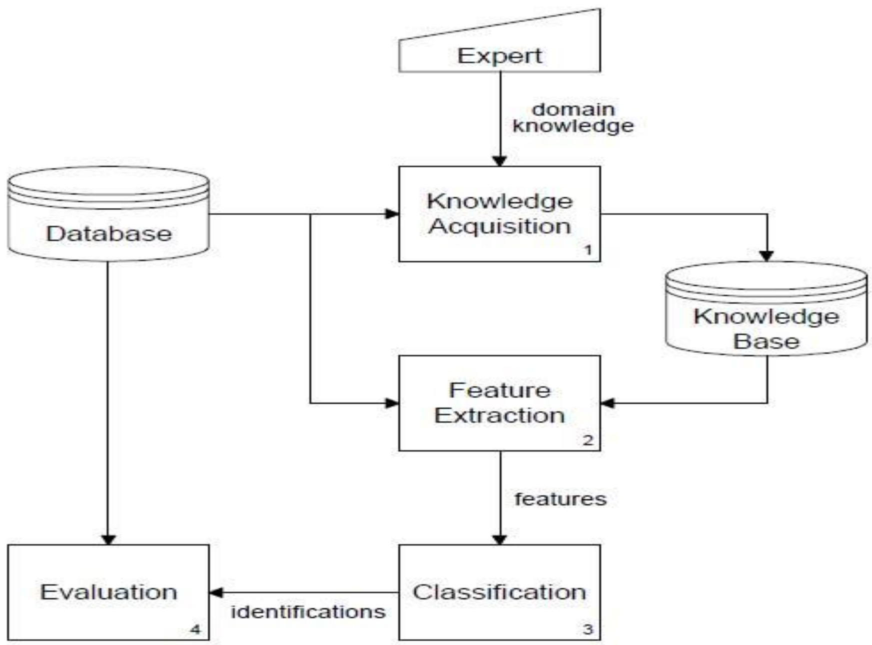

Fig.2.2(b) Structural Pattern Recognition

C. NEURAL PATTERN RECOGNITION METHOD

In most networks, the principle of learning a network is based on minimizing the gradient of error [4,5]. Therefore it is assumed that a network has a minimum error at the end of learning process [6] but it is not always happened like this. Sometimes because of the largeness of the domain of changes of the input network signal, the activity function of some neurons will be saturated and at last the output of these categories of neurons will be fixed in their border amount. It can make a same situation for the next layers of neurons. With continuing this situation, the network will be in a stable mode. In this case the output of neurons will be fixed and continuing learning is not useful because the network is trapped at a minimum position as a cure we can teach the neurons activity function gradient like links weight. Among neurons activity functions sigmoid function (one directed & two directed) has the most application, therefore studying the mathematical form of the network.

Designing a neural network which is used error back propagation algorithm is not only a science butalso anexperimental work. The reason is that many factors are engaged in designing a network which are the results of researcher's experiences however with considering some matters we can lead the back propagation algorithm to betterPerformance[7][8][9].

The model of a network comprises analog cells like neuron. Fig.3 shows an instance of these cells which are used in a network. This multi layer hierarchal network is made of lots of cell layers. In this network there are forward and backward links between cells. If this network is used for recognizing the pattern in this hierarchy, forward signals handle the process of recognizing pattern whereas backward signals handle the process of separating patterns and reminding. We can teach this network to recognize each set of patterns. Even being extra instigators or lack in patterns, this model can recognize it. It is not necessary that the complete reminding recognize manipulated shapes or the shapes that are changed in size or convert the imperfect parts to the main mode.

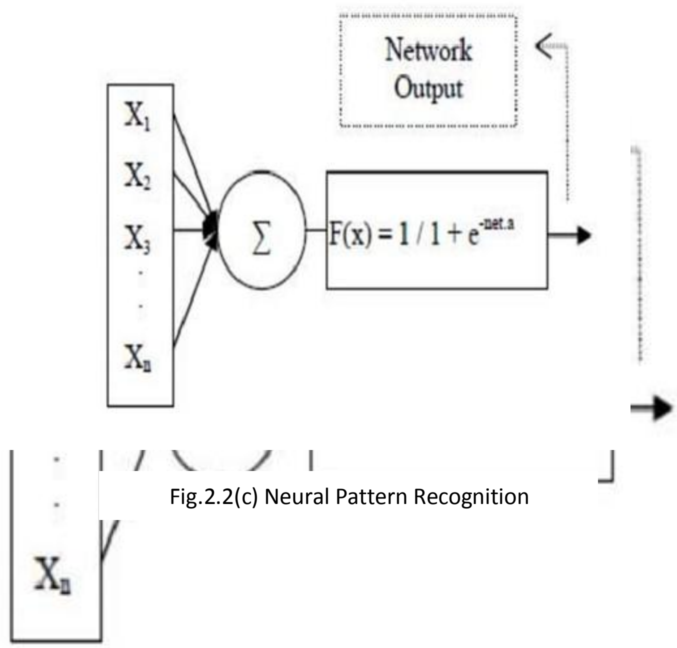

Fig.2.2(c) Neural Pattern Recognition

3.1 IMAGE REPRESENTATION

Before we discuss image acquisition recall that a digital image is composed of m rows and n columns of pixels each storing a value. Pixel values are most often grey levels in the range 0-255(B-W).WE will see later on that images can easily be represented as matrices.

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & \\ a_{31} & a_{32} & a_{33} & \cdots & \vdots \\ \vdots & & \vdots & & \\ a_{n1} & a_{n2} & \cdots & & a_{nn} \end{bmatrix}$$

Fig.3.1 Image Representation

3.2 IMAGE SENSING

Incoming energy lands on a sensor material responsive to that type of energy and this generates a voltage. Collections of sensors are arranged to capture images.

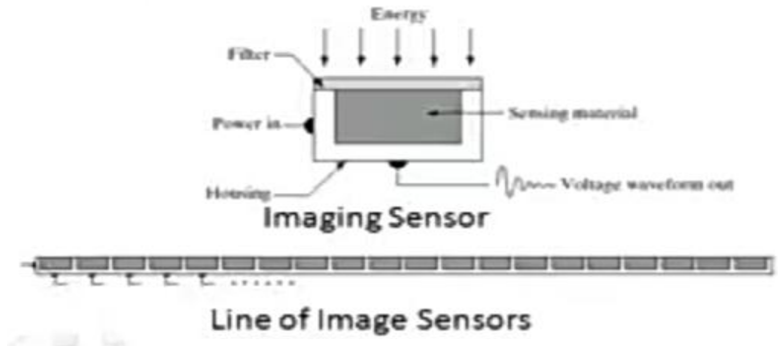

Fig.3.2 Image Sensing

3.3 IMAGE ACQUISITION

Images are typically generated by illuminating a scene and absorbing the energy reflected by the object in that scene.

-Typical notions of illumination and scene can be way off:

- X-ray of skeleton
- Ultrasound of an unborn baby
- Electro-microscopic images of molecules

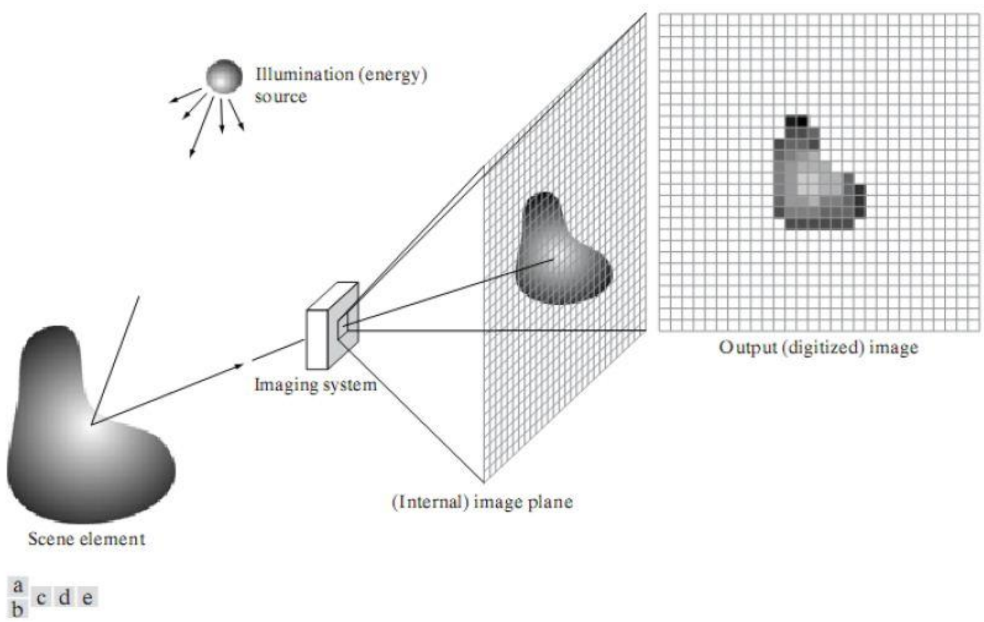

Fig. 3.3 Image Acquisition

4. SAMPLING AND QUANTIZATION

An image may be continuous with respect to the x- and y- coordinates, and also in amplitude To convert it to digital form, we have to sample the function in both coordinates and in amplitude.Digitizing the coordinate values is called Sampling. Digitizing the amplitude values is called Quantization.A digital Sensor can only measure a limited number of samples at a discrete sets of energy levels.Quantization is the process of converting a continuous analog signal into a digital representation of the signal.

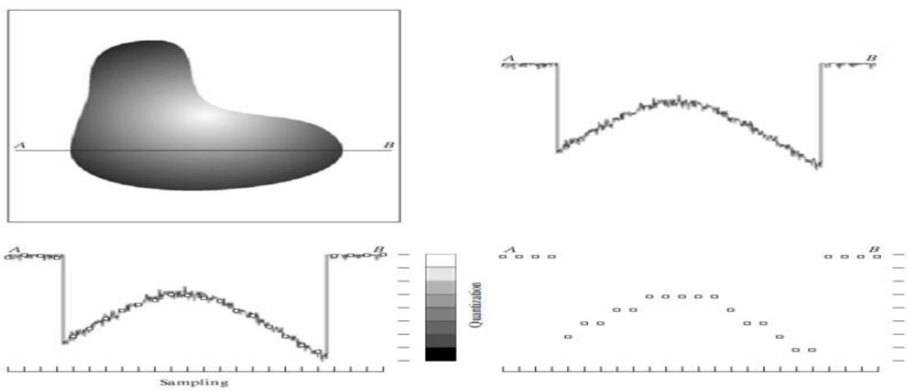

Fig.2.4 Sampling and Quantization

5. CONCLUSION

Pattern Recognition usually classified according to the kind of learning procedure use to get the output worth. In straightforward sense pattern recognition is that the heart of all scientific enquiry, as well as understanding ourselves and also the world around us. Now a day the development of pattern recognition is increasing very fast. In this paper we navigate pattern recognition in the round, include the definition of pattern recognition. The methods of PR, the composition of PR system and figures related to PR. In addition, it is important trend to use pattern recognition on engineering applications one should make effort on PR.

Image Processing quality of images increases as N & k increase sometimes, for fixed N, the quality improved by decreasing k(increase contrast).For images with large amount of details, few grey levels are needed.

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