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Feature Based Object Detection Using DWT Technique: A Review

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Abstract-: **Detecting the salient regions on feature points in an image is very fundamental and important task to digital image processing. There are numbers of techniques present now days for recognizing the objects in an image. One of most popular techniques include is feature based method. The paradigm that is followed in the dissertation is to detect the object based on features. The feature based techniques include SIFT, SURF, FAST, MSER and so on. This study presents only one method for scale and rotation invariant features descriptors that is SIFT based on transformation techniques DWT. A Haar wavelet type of wavelet transform is used in review and these are the forms that are used in many methods of discrete wavelet transform and processing.**

***Keywords*-Digital image processing, object detection, SIFT, DWT, Descriptor.**

I. INTRODUCTION

1.1 Digital Image Processing -:

Image Processing now a days is used in almost every area. Especially, it is finding its use in an application area such as the quality based studies, generalizes its use with its structure that meets the needs of the people.

Before actually going to the concept of Digital Image Processing we must have an idea of what actual digital image is? Digital images are the images which are expressed with numbers. They are created using the binary number system i.e. base of the computer and expressed with BIT's. Images are the most common and convenient sort of means for conveying and transmitting the information. Someone said "A picture is worth you thousand words", simply shows that the images can easily convey the information about the object. Digital Images are electronic snapshots taken of a scene or scanned from documents, such as photographs, manuscripts, printed texts, and artwork. The digital image is sampled and mapped as a grid of dots or picture elements (pixels). Each pixel is assigned a value (black, white, shades of gray or colour), which is represented in binary code (zero's and one's). **[3]**

Technically DIP is an act of bringing out the data i.e. obtained in the wake of the identification and detecting of the image that the digital environment carries out. It is the process of modification done upon images or the sequence of images in digital environment.

Most of the IP techniques treat the images as a 2D signal and then applying standard techniques to it. DIP involves a number of fundamental steps such as: image acquisition, image enhancement and pre-processing, edge detection and segmentation, representation, description, matching and recognition. The output of these steps is either an image itself or an attribute of an image. **[1]**

1.2 Pixel Representation

The digital image processing deals with manipulating the images with the help of operations applied on the digital images. An image is a two dimensional signal. It can be defined by the mathematical function F(x,y) where x and y are the two co-ordinates horizontally and vertically and the amplitude of F at any pair of coordinate (x, y) is called the intensity or gray level of the image at that point.

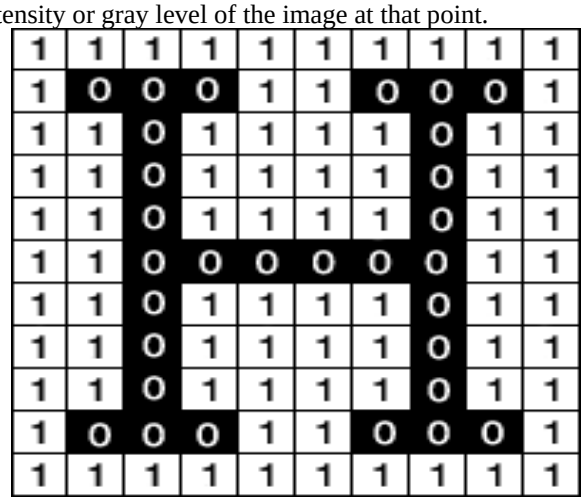

Fig.1 Pixel Representation

When x, y and the amplitude values of F are all finite discrete quantities, the image is known as a digital image. A digital image is composed of a finite number of elements, each of which has a particular location and values of these elements are referred to as picture elements, image elements, pels or pixels. Pixel is the very basic element of an image. In computer, the entire data is represented logically in binary form and each pixel holds a defined amount of information e.g. 0 and 1. Here in the figure '1' is representing the 'white' and '0' is representing the 'black'.

Image data in the computer is displayed as a rectangular arrangement of the very basic element of an image (pixel) arranged horizontally and vertically. Every image has a resolution which is the measure of number of pixels per row and the columns.[2] Resolution can be measured in many ways such as : Samples per inch (spi, scanners), Pixels per inch (ppi, monitors), Dots per inch (dpi, printers) etc. more pixels in a particular area will give a smoother and more detailed image but at the same time it will also increase the size of the file.

Image processing is performs mainly in three steps: First, the input device (or digitizer) to import images with an optical devices like a scanner or a camera or directly through digital processing.

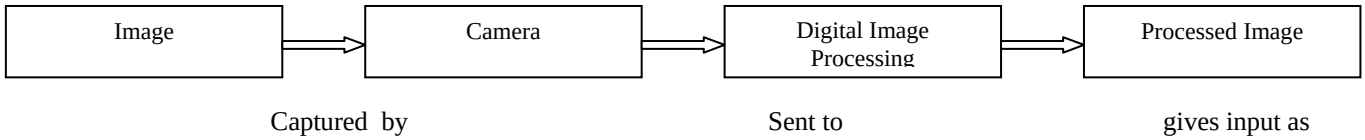

Fig.2 Digital Image processing system

Second, the digital processor to manipulate or analyze the images in some way. This step can include image improvement and data summary, or the images are analyzed to find rules that aren't seen by the human eyes.

Last, the output device, to display the result of an image processing. The result might be the image changed by some way or it might be a report based on analysis or result of the images.

There are 4 basic steps in IP: Pre-processing, Segmentation, Feature extraction and detection and these have very strong importance in research. Pre-processing step is carried out enhancing the quality of the original image with the help of removing noise, balancing brightness and contrast or by separating the background in an image. At the stage of feature extraction, the extraction is performed on every detected object to reduce its information to a list of parameters storing in memory. **[1]**

1.3 History of digital image processing-: Many of the techniques if digital image processing are developed in 1960s at the university of Maryland and few other research facilities within application to satellite of imagery, wire photo standards conversion, medical imaging videophone character recognition and photograph enhancement. The cost of processing was fairly high however with the computing equipment but change in 1970s when DIP proliferated hardware become available, images then can be processed in real time for some dedicated problems such as television, standard conversion. With the fast computer and signal processor available in2000s digital image processing has become the most common form of image processing and generally used because not only versatile but also cheapest .

1.4 Applications of Digital Image Processing:

- Image sharpening and restoration
- Medical field
- Remote sensing
- Transmission and encoding
- Machine/Robot vision
- Colour processing
- Pattern recognition.
- Object Detection.

1.5 DIP in MATLAB-: MATLAB provides small set of functions that supports for laboratory projects. In MATLAB the DIPUM toolbox as a set of more than 120 functions from DIP using MATLAB and also provides M-functions that are user contributed available for math work in image processing MATLAB. Highly recommend the image processing toolbox from math work as the premiere commercial framework for digital image processing. in addition to additional functionality the IP toolbox is complemented by extensive resource of the MATLAB software packet such as wavelet, neural network and signal processing. To process image with computer algorithm DIP is used of computer algorithm to create process and communicate and display digital images. **[4]**

2. OBJECT DETECTION

In general, object detection means where the object in an image is.

2.1 Objects-: The choice of stimuli to be used in object recognition. Some researcher use familiar, everyday objects arguing that this allows for a direct investigation of the visual processing.

Object detection, tracking, and recognition in images are very key problem in computer vision. Object detection is a technique or method for identifying the objects in an image or it can be simply defines as the task of finding and identifying the objects in the real world from an image of the world with the help of object models which are known priory. But if we talk about the computer vision it can be termed as the task to perform. Humans can recognize the objects effortlessly without being aware of the changes in an object's appearance due to number of factors such as view point variation, shadow, illumination etc. To detect a object from digital image is major task in image processing. It is a hot research issue to detect and classify the features based on IP technology. **[7]**The detection process in the image is carried out by the process of extracting the key points from an image which is very important and valuable. These key points have many applications in image processing like the detection of objects in an image, registration of an image, tracking of an object. Object and shape recognition etc. by simply extracting the key points, we can use them for find the particular objects in number of images. If the points matched in the images they can simply be categorized as the detected object in an image. object detection mainly consists of two steps:

Feature detection and classification. In the features detection step, the relevant feature of the object to be detected is gathered. These features are input to second step, classification the goal of classification is to find out whether the detected feature correspond to feature that the object is to be detected would have. Normally, objects are collection of features. A feature leads to be very low level primitive thing. An object implies moving the understanding of scene to next level up. A feature might be something like a corner, a edge etc. whereas object might

be something like a book, a desk. These objects are all composed of multiple features some of which may be visible in any given scene.

2.2 Scientific fundamental:

The concept of object detection with the help of machine is totally inspired by the Human visual System. People are capable of detecting objects under many variations in conditions. Human from many decades is trying to map this property of vision system to the machine.

For identifying and detecting the objects in an image the system must select the appropriate tools and techniques. The appropriate methods must be applied for the desired results. From decades human is trying to map the human vision system to the machine, which can be of great help in industries, biometric system and many more.

2.3 Approaches/ Methods of Object Recognition-:

Generally there are two methods available for recognizing the object, they are:

a). Appearance Based Object Recognition.

b).Feature Based Object Recognition.

a. Appearance based method: Appearance based method give the promising result in object recognition. Appearance-based methods are mostly exploited in the recognition of specific objects, especially faces; while methods with local features are often applied to the recognition of generic objects. Appearance based methods Use example images (called templates or exemplars) of the objects to perform recognition

b. Feature Based method: - The central idea of feature based object recognition algorithm lies in finding interest points, often occurred at intensity discontinuity that are invariant to change due to scale illumination and affine transformation. A search is used to find feasible matches between object features and image features. **[9]**

2.4 Features based approach:- Scale-invariant feature transform (SIFT)- It is an algorithm in computer vision to detect and describe local features in image and was published by David Lowe in 1999s.object recognition, robotic mapping and navigation, 3D modelling, gesture recognition are its applications.

- Key points of objects are first extracted from a set of reference images and stored in a database.
- An object is recognized in a new image by individually comparing each feature from the new image to this database and finding candidate matching features based on Euclidean distance of their feature vectors.

The SIFT (scale invariant feature transform) is one of the most widely used feature representation scheme for vision application. the SIFT approach is able to extract feature that are intensive to certain scale and illumination changes .SIFT based methods are expected to perform better for objects with rich texture information as sufficient no. of point can be extracted. on the other hand they also require sophisticated indexing and matching algorithm for effective object recognition. **[2]**

3. DISCRETE WAVELET TRANSFORM (DWT)

3.1 Introduction- A DWT is any wavelet transform for which the wavelets are discretely sampled. In case of images, image has been decomposed on wavelet decomposition techniques using transform with different levels of decomposition. Decomposition mainly performs on two different images.

Wavelet consists of many types like Haar, Morlet, Daubechies etc. Haar is the first DWT, was invented by Hungarian mathematical Aefred Haar. For an input represented by list of 2n numbers, the Haar wavelet transform may be considered to pair up input values, storing the difference and passing the sum. The discrete wavelet transform, a generalization of Fourier analysis, is widely used in several signal and image processing applications. **[9]**

Haar Wavelet- Haar functions are used since 1910. They were introduced by Hungarian mathematician Alfred Haar .Nowadays, several definitions of the Haar functions and various Generalizations as well as some modifications were published and used. One of the best modifications, which was introduced, is the lifting scheme These transforms have been applied, for instance, to spectral techniques for multiple–valued logic, image coding, edge extraction, etc. Over the past few years, a variety of powerful and sophisticated wavelet based schemes for image compression. Wavelet scheme gives many advantages, which are used in the JPEG–2000 standard as wavelet–based compression algorithms. **[6]** Generally, wavelets, with all generalizations and modifications, were intended to adapt this concept to some practical applications. The Discrete Wavelet Transform uses the Haar functions in image coding, edge extraction and binary logic design and is one of the most promising techniques today.

3.2 Wavelet Transform in Digital Image Processing and features extraction – The primary motivation behind image processing is to change over an image into significant information. Image enhancement is the most important step that must be carried out in all image handling applications. Transformation of digital image becomes a major method of communication in modern age, but the image obtained after transmission the data tends to get noisy and thereby the further processing does not lead to good results. Hence, pre-processing of image is very essential. The pre-processing being worked upon is the denoising of an image .The received image needs processing before it can be used in applications. Image denoising involves the manipulation of image data to produce a high quality image and wavelet transform have been applied.**[10]**

4 CONCLUSIONS

Basics of digital image processing and object detection has been described in the paper. Among them, feature based technique is described with two of its algorithms SIFT fused with technique DWT using Haar wavelet used for decomposition of an image and SIFT which is scale invariant and used to detect the objects from the image and detecting the key points and features present in the image. corner detection technique is also applied on decomposed image.

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