Digital Image Processing Real Time Applications

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ABSTRACT

Image processing and computer vision is an important and essential area in today's world. Several problems can be solved through computer vision techniques. There are a large number of challenges and opportunities that require skills in the field of computer vision in order to address them. Computer vision applications cover each band of the electromagnetic spectrum, and there are numerous applications in every band. This article is targeted to research students, scholars, and researchers who are interested in solving problems in the field of image processing and computer vision. It addresses the opportunities and current trends of computer vision applications in all emerging domains. The research needs are identified through an available literature survey and classified in the corresponding domains. Importance of digital image processing and its applications are also discussed from the fields of computer vision and other applications. An image is defined as an array, or a matrix, of square pixels arranged in rows and columns. Image processing is a procedure of converting an imag into digital form and carry out some operation on it, in order to get an improved image and to retrieve some important information from the image.

KEY WORDS

Biomedical imaging , Digital image processing, Image analysis, Applications, Image Acquisitions:

Introduction

Digital image processing deals with manipulation of digital images through a digital computer. Image processing is the application of signal processing techniques to the domain of Images — two-dimensional signals such as photographs or video. Image processing does typically involve filtering or enhancing an image using various types of functions in addition to other techniques to extract information from the images. The most common example is Adobe Photoshop. It is one of the widely used application for processing digital images. It also means "Analyzing and manipulating images with a computer ". Image processing is performed this three steps: First, import images with an optical devices like a scanner or a camera or directly through digital processing .Second, 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. For example, meteorologists use this processing to analyze satellite photographs. Last, output the result of 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. In the Fig.1 an image has been captured by a camera and has been sent to a digital system to remove all the other details, and just focus on the water drop by zooming it in such a way that the quality of the image remains the same.

An image may be defined 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 coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image. The field of digital image processing refers to processing digital images by means of a digital computer Vision is the most advanced of our senses, so it is not surprising that images play the single most important role in human perception. However, unlike humans, who are limited to the visual band of the electromagnetic (EM) spectrum, imaging machines cover almost the entire EM spectrum, ranging from gamma to radio waves. They can operate on images generated by sources that humans are not accustomed to associating with images. These include ultrasound, electron microscopy, and computer-generatedimages. Thus, digital image processing encompasses a wide and varied field of applications.

1. ***Biomedical Image Enhancemssent & Analysis*** *-Biomedical image enhancement is very important issue for biomedical image diagnosis, the aim of this area is to enhance the biomedical images. In addition to originally digital methods, such as Computed Tomography (CT) or Magnetic Resonance Imaging (MRI), initially analog imaging modalities such as traditional applications like endoscopy or radiography are nowadays equipped with digital sensors. Digital images are composed by individual pixels to which points to discrete brightness or different color values. After biomedical image enhancement & proper analysis, they can be efficiently processed & objectively evaluated.*
2. ***Medical Palmistry-*** *Palmistry is a science which observes human palm by different aspects and derives conclusions about nature of the person. Since from ancient times, many civilizations like Indian, Chinese, Persian, Egyptian, Roman and Greek, people were used to get guidance about their present and future by means of palmistry. It includes attributes of human, like, health, psychology, intelligence, lifestyle and other related entities. Medical palmistry can be considered as one of the branches of palmistry. By using this medical palmistry, probable diseases can be identified by observing some symbols in human palms such as Iceland, cross, grill, spot, star, square and circle. Additionally shapes of palm and fingers also play very important role in such decision making for identification of diseases.*

(a) (b) (c)

Examples of (a) CT Scan image of brain, (b) X-ray image of wrist and (c) MRI image of brain

(i) *Localizing the objects of interest, i.e. different organs*
(ii) *Taking the measurements of the extracted objects, e.g. tumors in the image*
(iii) *Interpreting the objects for diagnosis.*
(iv) *The process of analysis using digital image processing can be divided into various phases. The blocks diagram of a digital image processing (DIP) system*

1. Image Acquisition*: It is the first step or fundamental step of digital image processing. Under image acquisition the image is given in digital format. Generally, this stage of image acquisition stage involves preprocessing, such as scaling etc. An image can be made input by some sort of scanner, digital cameras or with the help of aerial cameras .This image should be a high quality image with greater resolution, which helps in proper image analysis.*

2. Preprocessing *- Some preprocessing operations are required to be performed on the input image. The aim of preprocessing techniques is to improve the image data to suppress the unwanted distortions and to enhance some features of the input image. When processing high resolution images, the image size is needed to be reduced because of the reason that processing on high resolution images takes a longer time. Then after the color image is converted into grey scale image, because less information is needed to be provided for each pixel. In fact grey color is the one in which the red, blue and green components contain equal intensities; therefore it is necessary to specify a single value of intensity level for each pixel.*

3. Edge Detection & Segmentation *- Under edge detection some points are required to be identified to capture some important changes and events in the properties of the image. In case of image segmentation, image is identified into multiple segments. In form of these segments an image that is more meaningful and easy to analyze. Segmentation is accomplished by scanning the image pixel by pixel and then after each pixel is labeled, depending on whether the grey level is greater or less than the threshold value.*

4. Image Restoration*: Image restoration is an area, in which the appearance of an image is improved. Image restoration techniques are based on mathematical models or probabilistic analysis of an image. There are various filter available or can be designed for the restoration and to enhance the quality of an image.*

5. Output Image *- After using various image processing techniques accompanied with morphological operation on digital image, the object of interest from the given image can be obtained*

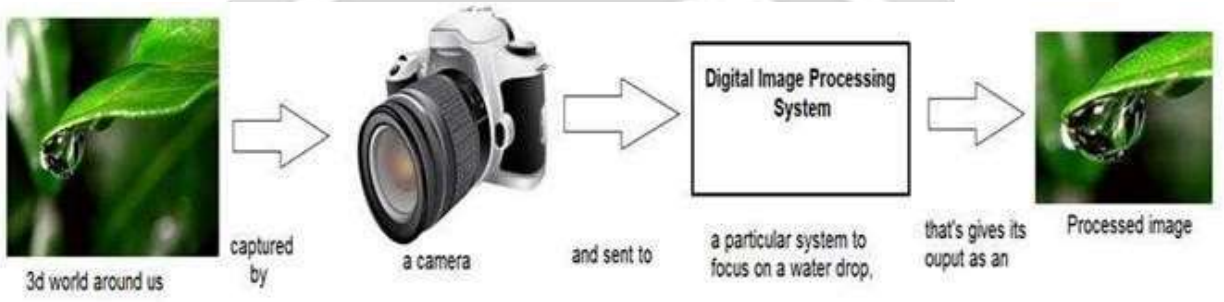

Fig:-how digital image processing works

resources, etc., can be extracted based on remotely sensed image analysis. For remotely sensed scene analysis, images of the earth's surface arc captured by sensors in remote sensing satellites or by a multi-Spectra) scanner housed in an aircraft and then transmitted to the Earth Station for further processing [3, 4]. We show examples of two remotely sensed images in Figure 1 whose color version has been presented in the color figure pages. Figure (a) shows the delta of river Ganges in India. The light blue segment represents the sediments in the delta region of the river, the deep blue segment represents the water body, and the deep red regions are mangrove swamps of the adjacent islands. Figure (b) is the glacier flow in Bhutan Himalayas. The white region shows the stagnated ice with lower basal velocity.

(a) *(b)*

Fig. : Example of a remotely sensed image of (a) delta of river Ganges, (b) Glacier flow in Bhutan Himalayas

Techniques of interpreting the regions and objects in satellite images are used in city planning, resource mobilization, flood control, agricultural production monitoring, etc.

Image Acquisitions:

Most of images are generated by the combination of an ―illumination‖ sources and the reflection or absorption of energy from that source by the element of the ―scene‖ being imaged.
For example the illumination may originated from a source of EM energy such as RADAR, X-ray system. Image acquisition can be done with the help of single sensor or array of sensor.

1. Image Enhancement
It is the process of manipulating an image so that result is more suitable than the original for a specific application. Image enhancement improves the subjective quality of the image by working with the existing data
Image enhancement is achieved in the following two domains

- *In the spatial domain*
- *In the Frequency domain*

2. Image Restoration
It is an area that also deals with improving the appearance of an image. Image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic model of image degradation.

3. Morphological Processing
It deals with tools for extracting image components that are useful in the representation and description of

4. Color Image Processing
The use of color image processing is motivated by two principal factors. They are as given below

- *Color is a powerful descriptor that often simplifies object identification and extraction from scene.*
- *Human can discern thousand of shades and intensities, compared to about only two dozen shades of gray. Color image processing is divided into two major areas.*

(i) Full-color processing.
(ii) Pseudo color processing.

Conclusion

The basics of image processing such as Image, image-analysis and understanding, image-transforms, compression techniques, optical character recognition (OCR) and its applications such as video and 3D graphics firmness, Remote Sensing, Pattern gratitude, Multimedia interacting and Virtual reality, and medical image processing are discussed in this paper.

This study will help the researchers to work on various fields such as image processing, fault detection in industrialized Industries, medical image segmentation. The biggest limitation of all these algorithms is that the accuracy of these algorithms is dependent on the resolution quality of camera and view angle between camera and the target object. It is also observed that at some angles the results were not accurate beyond a certain range of camera. The future of digital image processing involves new intelligent, digital automated robots created entirely by research scientists in various nations of the world. Advance researches in image processing and artificial intelligence will involve voice commands, anticipating the information requirements of governments, translating languages, recognizing and tracking people and things, diagnosing medical conditions, performing operation & surgery, reprogramming defects in human DNA, and automatic driving all formats of transportation. With increase in power and sophistication of modern computing, the concept of computation can be extended beyond the present limits. In future, image processing technology will be more advanced and the visual system of man can be replicated. The future trends in remote sensing will be aiming towards various improved sensors that can record the same scene in many spectral channels.
Graphics data is also getting tremendously importance in the field of digital image .

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