Digital Image Processing-A Quick Review

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ABSTRACT

Image is one of the evident sources in image processing applications. Image processing will dramatically change the human computer interaction in future. A large number of image processing applications, tools and techniques helps to extract complex features of an image. While today image processing works beyond multidimensional and see what actually in the image. Several technologies playing on images in real time but image processing is the real core. This paper discusses the overview of an image processing applications, tools and techniques.

INTRODUCTION

The Image is defined by a function called Two-Dimensional image. It can be specified by spatial coordinates as plane coordinates and its pair coordination are amplitude, which may represented as f(x,y).The intensity of those coordinates were x and y of gray level images. When the spatial coordinates and the intensity values are finite with discrete quantities then it is called as Digital image processing. The digitized images can be easy to analyse and manipulate in order to improve the quality with the use of some mathematical calculations. Here the image is given as an input, parameters of an image as processed through algorithms and characteristics related to the images as an output.

Digital Image Processing (DIP) is the process of digital images through various algorithms. This digital image processing has been employed in number of areas such as pattern recognition, remote sensing, image-sharpening, color and video processing and medical.

This paper has been organized as follows, literature part explains various review of authors and discusses about the various applications in Digital Image Processing (DIP). Latest image processing tools and its techniques has discussed in last part.

REVIEW OF LITERATURE

Ranu Gorai discussed about how the image and picture are defined in our daily life and clearly explained about three methods such as sharpening the edges, noise removal and removing the motion blur for an image [1].Jangala Sasi Kiran et al., proposed an algorithm to improve the overall accuracy of the hand written character under pattern recognition field using image processing techniques like feature extraction, image restoration and image enhancement [2].

B Thamotharan Ed al, proposed that the digital image processing concepts are done by different algorithms and highlighted noise and edge detection algorithm. He discussed another two concepts like mean and median filtering for radiographic images and compared them [3].

Shafiqua T. Pathan Ed al, proposed that this paper mainly focusing on the security based system by modern digital image processing also this paper gives a way to process a videos from variety of video devices. First set the continuous frames from the videos then it had been processed under SUSAN for extracting the features [4].

Dipen Saini exposed about the data clustering for clustering of objects. A specific algorithm is used for group detection from an image using distance metrics through linear features [5].

Mostafa Bayati Ed al proposed that the main contribution of this research is plant phenotyping research or the automation of research in image acquisition to minimize the data at geo referencing errors and for modular data visualizations and also fastest data collections [6].

Mohammad Nazmul Haque et al., discussed about accelerating performance on FFT based image processing algorithm between Central Processing Unit (CPU) and Graphics Processing Unit (GPU) [7]. Zijiang Zhu et al, proposed an age estimation algorithm for facial images using multi-label sorting. They changed the tedious process in traditional multi valued classification algorithm and compared the results with some classic algorithms of age estimation by verified the efficiency and accuracy of the algorithm [8].

APPLICATIONS IN DIGITAL IMAGE PROCESSING

Since digital image processing has widely applied in many applications and almost all of the technical fields are impacted. Digital Image processing is not just limited to adjust the spatial resolution of the everyday images captured by the camera. It is not just limited to increase the brightness of the photo. Electromagnetic waves can be thought of as stream of particles, where each particle is moving with the speed of light. Each particle contains a bundle of energy. This bundle of energy is called a photon.

In this electromagnetic spectrum, we are only able to see the visible spectrum. Visible spectrum mainly includes seven different color that are commonly term as (VIBGOYR). VIBGOYR stands for violet, indigo, blue, green, orange, yellow and Red. But that does not nullify the existence of other stuff in the spectrum. Our human eye can only see the visible portion, in which we saw all the objects. But a camera can see the other things that a naked eye is unable to see. For example: x rays, gamma rays, etc. Hence the analysis of all that stuff too is done in digital image processing [9]. Some of the major Application fields in which digital image processing is widely used are mentioned below

Image sharpening and restoration

Image sharpening and restoration refers to process images that have been captured from the modern camera to make them a better image or to manipulate those images in way to achieve desired result. It refers to do what Photoshop usually does. This includes Zooming, blurring, sharpening, gray scale to color conversion, detecting edges and vice versa, Image retrieval and Image recognition.

Medical field

The common applications of DIP in the field of medical is, gamma ray imaging, PET scan Ray Imaging, Medical CT, UV imaging. DNA analysis, fingerprint and facial recognition are evident applications of image processing.

UV Rays

In the field of remote sensing, the area of the earth is scanned by a satellite or from a very high ground and analysed to obtain information about it. One particular application of digital image processing in the field of remote sensing is to detect infrastructure damages caused by an earthquake. As it takes longer time to grasp damage, even if serious damages are focused on. Since the area effected by the earthquake is sometimes so wide, that it not possible to examine it with human eye in order to estimate damages. Even if it is very hectic and time consuming procedure and found a solution in digital image processing. An image of the affected area is captured from the above ground and analyzed to detect the various types of damage done by the earthquake. Key steps include in the analysis are, the extraction of edges, Analysis and enhancement of various types of edges.

Transmission and encoding

The very first image that has been transmitted over the wire was from London to New York via a submarine cable. The picture took three hours to reach from one place to another. Now able to see live video feed, or live CCTV footage from one continent to another with just a delay of seconds. It means that a lot of work has been done in this field too. This field does not only focus on transmission, but also on encoding. Many different formats have been developed for high or low bandwidth to encode photos and then stream it over the internet.

Machine/Robot vision

One of the biggest challenges still is to increase the vision of the robot. Developed a robot able to see things, identify them and identify the hurdles etc. Much work has been contributed by this field and still developing.

Hurdle detection

Hurdle detection is one of the common tasks that have been done through image processing, by identifying different type of objects in the image and then calculating the distance between robot and hurdles.

Color processing

Color processing includes processing of coloured images and different color spaces that are used. For example, RGB color model, Cyber, HSV. It also involves studying transmission, storage, and encoding of these color images.

Pattern recognition

Pattern recognition involves study on image processing and from various fields that includes machine learning (a branch of artificial intelligence). In pattern recognition, image processing is used for identifying the objects in images and then machine learning is used to train the system for the change in pattern. Pattern recognition is used in computer aided diagnosis, recognition of handwriting and recognition of images.
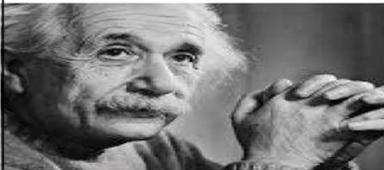
S. NO	APPLICATIONS	IMAGES	REFERENCES
1	Image sharpening and restoration		http://www.engpaper.com/application-of-digital-image-processing.htm
2	UV imaging		https://www.tutorialspoint.com/dip/applications_and_usage.htm
3	Transmission and encoding		http://www.engpaper.com/application-of-digital-image-processing.htm
4	Hurdle detection		http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.331.5867&rep=rep1&type=pdf

Table.1 Applications of Image Processing

Video processing

A video is the very fast movement of pictures. The quality of the video depends on the number of frames/pictures per minute and the quality of each frame being used. Video processing involves noise reduction, detail enhancement, motion detection, frame rate conversion, aspect

ratio conversion, and color space conversion [10]. Images specified in image processing applications are listed below.

TOOLS AND TECHNIQUES IN DIGITAL IMAGE PROCESSING

Tools

An Image Processing tools are the major evaluation part for developing, monitoring and making the images in proper consistencies. This will describe about the major functionalities occurring at the implementation of coding by the basis of certain algorithms. On such important notes in this paper it shows various tools processing components listed in the Table-2 below.

Techniques

a)   Image Editing: - This basically means altering digital images by means of graphic software tools.

b)   Image Restoration: - which refers to the estimation of a clean original image out of the corrupt image taken in order to get back the information lost.

c)   Independent Component Analysis: -which separates a multivariate signal computationally into additive subcomponents.

d)   Anisotropic Diffusion: - which is often known as Perona-Malik Diffusion, makes it possible to reduce image noise without having to remove important parts of the image.

e)   Linear Filtering: -It's another digital image processing technique, which refers to processing time-varying input signals and producing output signals that are linearity.

f)   Neural Networks: - which are computational models widely used in machine learning for solving various tasks.

g)   Pixelation: - which often refers to turning printed images into digitized ones (Such as GIF).

h)   Principal Components Analysis: - A digital image processes technique that can be used for extraction.

i)   Partial Differential Equations: - which also is dealing with effectively de-noising images [11].

Tools	Tool Categories	Descriptions	References
Processing Tools	DIY Filters	DIY Filter examples from Coding Gestalt	https://en.wikipedia.org/wiki/Digital_image_processing
	Standard Filters	Processing makes it simple to handle images.	https://en.wikipedia.org/wiki/Digital_image_processing
	GPU Filters	You can also implement filters using OpenGL pixelshaders.	https://en.wikipedia.org/wiki/Digital_image_processing
	OpenCV Filters	OpenCV offers all kinds of algorithms from basic.	https://en.wikipedia.org/wiki/Digital_image_processing
	ImageJ Filters	Martin Schneider is currently working on a Processing Library / Wrapper for ImageJ.	https://en.wikipedia.org/wiki/Digital_image_processing
Python Tools	PIL	Iterate over the pixels of an image and perform operations on them.	https://en.wikipedia.org/wiki/Digital_image_processing
	SciKit-Image	SciKit-image is a collection of algorithms for image processing.	https://en.wikipedia.org/wiki/Digital_image_processing
	SimpleCV	SimpleCV is a python wrapper for OpenCV (and a couple of other tools).	https://en.wikipedia.org/wiki/Digital_image_processing
Dataflow Tools	FilterForge	FilterForge is a commercial application that lets you create filters using a node based dataflow programming language.	https://en.wikipedia.org/wiki/Digital_image_processing

CONCLUSION

A large number of image processing applications, tools and techniques helps to extract complex features of an image. Image processing works on single dimensional image to multidimensional and see what actually in the image. Image processing is the real core for many developing technologies in the real time aspect. This paper discusses the overview of an image processing applications, tools and techniques.

REFERENCES

1. Ranu Gorai (2016), A Survey of Digital Image Processing,International Journal of Research in Engineering, Technology and Science, VI(Special Issue)

2. Jangala Sasi Kiran, N Vijaya Kumar, N Sashi Prabha and M Kavya (2015), A Literature Survey on Digital Image Processing Techniques in Character Recognition of Indian Languages, International Journal of Computer Science and Information Technologies, 6(3), 2065-2069

3. B.Thamotharan, M.Menaka, Sandhya Vaidyanathan,Sowmya Ravikumar (2012), Survey on image processing in the field of de-noising techniques and edge detection techniques on radiographic images,Journal of Theoretical and Applied Information Technology, 41(1), 26-34.

4. Shafiqua T. Pathan, Sharyu S. Waghmare, Pranali P. Khadse, Pratik P. Shukla and Shrikant A. Wawre (2014), A Survey Paper On A Novel Approach For Image Classification Based On SUSAN Low Level Image Processing Algorithm From Real Time Video, International journal of scientific & technology research,3(2)

5. Dipen Saini (2016), Assembling of Human Beings in an Image to Detect a Group on the basis of Distance using Digital Image Processing, International Journal of Current Engineering and Technology, 6(2), 462-466

6. Mostafa Bayati and Reza Fotouhi (2018), A Mobile Robotic Platform for Crop Monitoring, Advances in Robotics, 7(1), 186-191

7. Bahri Haythem, Sayadi Fatma, Chouchene Marwa, Hallek Mohamed and Atri Mohamed (2016), Accelerating Fourier Descriptor for Image Recognition Using GPU, Applied Mathematics & Information Sciences An International Journal, 10(1), 297-306

8. Zijiang Zhu, Hang Chen, Yi Hu and Junshan Li (2018), Age estimation algorithm of facial images based on multi-label sorting, EURASIP Journal on Image and Video Processing,114

9. A Erhardt Ferron (2000), Theory and application of digital image processing, University of applied sciences. Offenburg.

10. P Prabhu (2016), Digital Image Processing Techniques – A Survey, Golden Research Thoughts, 5(11)

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