IMAGE PROCESSING SYSTEM USING JAVA

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Manuscript History
Number: **IJIRIS/RS/Vol.07/Issue04/APIS10084**
Received: 03, April 2020
Final Correction: 14, April 2020
Final Accepted: 22, April 2020
Published: **April 2020**
Citation: Utkarsh, Sudhanshu, Devansh, Parth & Ajay (2020). Image Processing System Using Java. International Journal of Innovative Research in Information Security, Volume VII,42-46-**doi://10.26562/IRJCS.2020.APIS10084**
Editor: Dr.A.Arul L.S, Chief Editor, IJIRIS, AM Publications, India

Abstract – The article is all about the Image Processing System that can be defined as, processing and altering an existing image in the desired manner. Image is one of the perceptible sources in applications of Image Processing including a large number of tools and techniques which help to extract complex features of an image. Probably the most powerful image processing system is the human brain together with the eye. The system receives, enhances, and stores images at enormous rates of speed. The objective of Image Processing is to visually enhance or statistically evaluate some aspect of an image not readily apparent in its original form. Several technologies playing on images in real-time but image processing is the real core. This paper discusses the overview of development; implementation of operations required for quality image production and also discusses image processing applications, tools, and techniques.

Keywords – Aspect Ratio; Brightness Transformation; Color Model; Digital Image; Edge Map; image system; processing ; java security;

I. INTRODUCTION

Digital image processing is a very popular and rapidly growing area of application under computer science and Information Technology engineering. Its growth leads by technological innovations in the fields of digital imaging, computer processing and mass storage devices. Fields which have been traditionally using analog imaging are now switching to digital systems, for their edibility and affordability. Some of the important examples are medicine, and video production, photography, remote sensing, and security monitoring. A digital image is a numeric representation of a two-dimensional image and may be defined as a function, f (x, y), where x and y are special coordinates and f is the amplitude commonly called as grey - level at the pair of coordinates (x, y). 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 applications for processing digital images. It also means "Analysing and manipulating images with a computer".

The goal of Image Processing System can be divided into 3 categories.

[1] Image processing in which input is an image and output is also an image
[2] Image analysis in which input is an image and outputs are the dimensions or measurements.
[3] Image understanding in which input is an image and output is the standard description of an image.

Image An image is an array, or a matrix of square pixels arranged in columns and rows. In a (8-bit) greyscale image intensity ranges from 0 to 255. A grey scale image normally known as black and white image, but the name emphasizes that such an image will also include many shades of grey. A normal greyscale image has 8-bit color depth = 256 greyscales. A “true color” image has 24-bit color depth = 8 x 8 x 8 bits = 256 x 256 x 256 colors = ~16million colors.

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There are several image file formats which are commonly used in daily life.

A. **GIF:** An 8-bit (256 color), non-destructively compressed bitmap format. mostly used for web.
B. **JPEG:** A very efficient (i.e. much information per byte) destructively compressed 24-bitmap format. Widely used, especially for web and Internet (bandwidth-limited).
C. **TIFF:** The standard 24 bit publication bitmap format. Compresses none destructively with, for instance, Lempel-Ziv-Welch (LZW) compression.
D. **PS:** Postscript, a standard vector format. Has numerous sub-standards and can be difficult to transport across platforms and operating systems.
E. **PSD:** A dedicated Photoshop format that keeps all the information in an image including all the layers.

For science communication, the two main colour spaces are RGB and CMYK.

RGB: RGB uses additive colour mixing and is the basic colour model used in television or any other medium that projects colour with light. It is the basic colour model used in computers and for web graphics. The secondary colours of RGB – cyan, magenta, and yellow – are formed by mixing two of the primary colours (red, green or blue) and excluding the third colour. Red and green combine to make yellow, green and blue to make cyan, and blue and red form magenta. The combination of red, green, and blue in full intensity makes white.

CMYK: The 4-colour CMYK model used in printing lays down overlapping layers of varying percentages of transparent cyan (C), magenta (M) and yellow (Y) inks. In addition, a layer of black (K) ink can be added. The CMYK model uses the subtractive colour model. The colours created by the subtractive model of CMYK don't look exactly like the colours created in the additive model of RGB Most importantly; CMYK cannot reproduce the brightness of RGB colours. In addition, the CMYK gamut is much smaller than the RGB gamut.

Gamut: The range, or gamut, of human colour perception is quite large. The two-colour spaces discussed here span only a fraction of the colours we can see. Furthermore, the two spaces do not have the same gamut, meaning that converting from one colour space to the other may cause problems for colours in the outer regions of the gamut’s.

II. TECHNIQUES

Image Processing System techniques are as follows:

A. **Image Enhancement:** Image enhancement is the method for providing the results of image to be clearer, by improving from original images so that the results are more suitable for display or further image analysis. It helps in removing noise, sharpening the image, or brightens an image, making it easy to identify key features. The process of enhancing the quality of images from the original image by removing the noise, provide the enhanced image by sharpening the original image and increasing contrast in image.

B. **Image Restoration:** Restoring the clear image from the degraded or corrupted image is provided by the technique called image restoration.

Corrupted/Blur images are due to noisy, blur images or camera misfocus. Blurring occurs due to formation of bandwidth reduction of an ideal image caused by imperfect image formation process. Thus the images will be restored into original quality by reducing the physical degradation.

C. **Image Compression:** Image compression is minimizing the size of bytes of a image file without degrading the quality of the image in order to obtain the image in more clarity. The reduction in file size allows more images to be stored in a given amount of disk or memory space. And also reduces the time during sending of images via networks or downloading from web pages.

D. **Image Segmentation:** Segmenting or partitioning the original image with some defined pixels into number of regions for the purpose of image analysis, depicts the features hidden in the normal image and object recognition, undefined boundary estimation, textures and motions. It is based on region and edges of image, segmentation is carried out.

E. **Image Recognition:** Image recognition technique involves in recognizing/ identifying and detecting features such as objects in video or images. During the recognition mechanism, images from the database are compared with the current image, if the match is found then further execution of process will be carried out in real time application.

III. APPLICATIONS IN IMAGE PROCESSING SYSTEM

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 is termed 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. Some of the major Application fields in which digital image processing is widely used are mentioned below

A. **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.

B. **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.

C. **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. 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.

D. **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.

E. **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.

F. **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

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H. Pattern recognition: Pattern recognition involves study on image processing and from various fields that includes machine learning. 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.

IV. SCOPE OF FUTURE APPLICATION

The future of image processing will involve scanning the heavens for other intelligent life out in space. Also new intelligent, digital species created entirely by research scientists in various nations of the world will include advances in image processing applications. Due to advances in image processing and related technologies there will be millions and millions of robots in the world in a few decades time, transforming the way the world is managed. Advances in image processing and artificial intelligence6 will involve spoken commands, anticipating the information requirements of governments, translating languages, recognizing and tracking people and things, diagnosing medical conditions, performing surgery, reprogramming defects in human DNA, and automatic driving all forms of transport. With increasing power and sophistication of modern computing, the concept of computation can go beyond the present limits and in future, image processing technology will advance and the visual system of man can be replicated. The future trend in remote sensing will be towards improved sensors that record the same scene in many spectral channels. Graphics data is becoming increasingly important in image processing app1ications. The future image processing applications of satellite based imaging ranges from planetary exploration to surveillance applications.

Using large scale homogeneous cellular arrays of simple circuits to perform image processing tasks and to demonstrate pattern-forming phenomena is an emerging topic. The cellular neural network is an implementable alternative to fully connected neural networks and has evolved into a paradigm for future imaging techniques. The usefulness of this technique has applications in the areas of silicon retina, pattern formation, etc. One of the basic image processing functions of some image processing software is the “object counter,” which is based on the Blob analysis. The Blob (Binary Large Object) algorithm is used for detecting the parameter of single objects inside an image. In plain terms, a Blob is an area of a digital image, in which some characteristics such as brightness or color are constant and differ from the background. In figure 5 for example every chocolate drop has an original Blob, which is silhouetted against the background with its gray and color values. The Blob-analysis now allows the separation of the relevant objects from the background (so called binarization) and then classifying the objects due to their size, geometry, position and orientation.

In the early days on the field of the Blob-analysis, it was used to maintain an image region (region of interest) for further processing. Those image regions could signal the presence of an object or parts of the object in an image, with the set task to recognize or trace objects. One of the first and also most popular Blob-analysis is based on the Laplacian of the Gaussian (LoG), which is a special form of the discrete Laplace-Filters and is used for detecting edges. In newer works the Blob descriptors are more and more used as interest-operators. These algorithms extract distinctive areas in images and deliver at the same time one or more parameters. Distinctive areas are points, which are in a bordered surrounding that is as unique as possible. Today the Blob-analysis can be used in many applications with time consuming calculations. Thereby it can exclude connected regions based on their characteristics that are not of interest. Also even statistical information can be determined, such as the size or number of Blobs, the position and presence of Blob regions.

V. CONCLUSION

This study is to make sure about the feasibility and accuracy of digital enhancement of images through various image processing techniques, applications, tools that helps to extract complex features of an image. Image processing works on a single-dimensional image to multidimensional a sees what actually in the image is. Image processing is the real core of many developing technologies in the real-time aspect. This paper discusses the overview of development, implementation of operations required for quality image production, and also discusses image processing applications, tools, and techniques.

ACKNOWLEDGMENT

The authors would like to thank our faculty guide, Mr. Ajay Kumar, Assistant Professor at Department of IT at Meerut Institute of Engineering and Technology, Meerut for facilitating the development of the paper, making available resources and also for final deployment.

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