

# A STUDY ON THE IMPORTANCE OF IMAGE PROCESSING AND ITS APPLICATIONS

Basavaprasad B<sup>1</sup>, Ravi M<sup>2</sup>

<sup>1</sup>Asst. Professor, Department of Computer Science, Govt. First Grade College, Raichur, Karnataka, India

<sup>2</sup>Asst. Professor, Department of Computer Science, Govt. First Grade College, Manvi, Raichur, Karnataka, India

## Abstract

A systematic study on importance of image processing and its applications to the field of computer vision is carried out in this paper. An image is defined as an array, or a matrix, of square pixels (elements of picture) arranged in rows and columns. **Image processing** is a procedure of converting an image into digital form and carry out some operation on it, in order to get an improved image and take out several helpful information from it. Mathematically image processing is defined as the processing of a two dimensional picture by a computer i.e., an image is defined as a function of two real variables, like  $t(x, y)$  with an amplitude such as brightness of an image at the coordinate point  $(a, b)$ . The outcome of image processing can be an image or a set of features or characteristics related to the image. Most image processing methods treats an image as a two-dimensional signal and implementing standard signal-processing techniques to it. The goal of this operation can be divided into 3 categories. Firstly image processing in which input is an image and output is also an image; secondly image analysis in which input is an image and output are the dimensions or measurements. Finally image understanding in which input is an image and output is the standard description of an image. Some of the important applications of image processing in the field of science and technology include computer vision, **remote sensing**, feature extraction, face detection, forecasting, optical character recognition, finger-print detection, optical sorting, argument reality, **microscope imaging**, lane departure caution system, **Non-photorealistic representation**, **medical image processing**, and **morphological imaging**.

**Keywords:** Image, Digital Image, Compression, Enhancement, OCR, ATR.

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## 1. INTRODUCTION

Image processing generally refers to digital image processing. It is also refers to optical and analog image processing. In this paper we, have presented a systematic study on image processing and its importance to the field of computer vision. The acquisition of images is called as imaging. Digital Image Processing (DIP) is multidisciplinary science that makes employ the principles from various fields such as optics, computer science, mathematics, surface physics and visual psychophysics. Some of the important applications of image processing in computer vision include, remote sensing, feature extraction, face detection, finger-print detection, optical sorting, argument reality, microscope imaging, lane departure warning system, Non-photorealistic representation, medical image processing, and morphological imaging [16]. An image contains sub-images often referred as regions or regions-of-interest. Images regularly contain groups of objects each of which is the basis for a region. Most generally, image processing requires the images to be available in digitized form. For digitization process, the input image is sampled on a separate lattice and every sample or pixel is quantized by a fixed number of bits. The processes the digitized image. To show a digital image, first it is converted into an analog signal that is scanned onto a output. Image processing is very closely related to computer vision and computer graphics. Within

computer graphics, images are physically prepared from environments, physical models of objects and lighting, as an alternative of being acquired through imaging devices from *natural* scenes, as in most animations. Computer vision is frequently measured good quality image processing by which computer or software means to interpret the objective contents of an image, a sequence of images. For example videos or three Dimension full-body magnetic resonance scans. Digital image processing allow the use of much more composite algorithms, and hence, can offer both more complicated performance at simple tasks, and the accomplishment of techniques which would be not possible by analog methods. Particularly, **digital image processing** is the alone experimental technology for:

- Classification of images
- Feature extraction
- Multi-scale signal analysis
- Pattern recognition
- Projection

Some technique used in digital image processing includes:

- Pixilation
- Self-organizing maps
- Hidden Markov models
- Partial differential equations

- Linear filtering
- Principal components analysis
- Independent component analysis
- Anisotropic diffusion
- Wavelets
- Neural networks

In modern sciences and technologies, images also increase a lot broader scopes because of the ever growing importance of scientific apparition (of often large-scale complex logical/investigational data). Examples include microarray data in real-time multi-asset assortment trading in finance or genetic research.

## 2. IMAGE PROCESSING & ITS APPLICATIONS

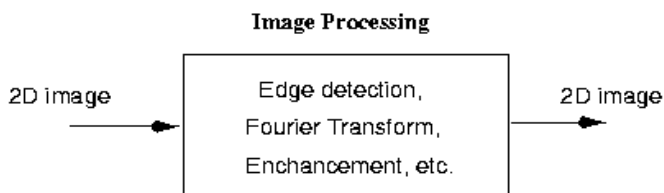
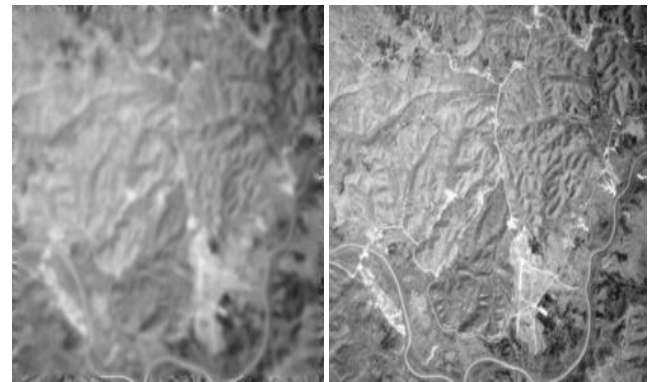


Fig -1: Block Map of Image Processing

### 2.1 Image Enhancement

Image enhancement encompasses the processes of changing images, whether they are traditional photochemical photographs, digital photographs or illustrations. Conventional analog image enhancing is known as photo retouching, using tools such as an airbrush to change photographs, or editing design with any medium of Traditional art. Graphic software programs, which can be broadly grouped into raster graphics editors, and three Dimensional modelers and vector graphics editors are the primary tools with which a user may influence, enhance, and transform images. Several image editing programs are also used to render or create computer art from scratch [1].



### 2.2 Image Restoration

Image restoration is the operation of taking a noisy/ corrupted image and estimates the clean creative image. Altered form may come in many forms such as motion blur, noise, and camera miss-focus. Image restoration is different from image enhancement. The latter is designed to highlight characteristics of the image which make the image more agreeable to the viewer, but not essentially to construct practical data from a scientific sense. Image enhancement methods like stretching contrast, de-blurring by a nearest neighbor process supplied by imaging packages do not use priori model of the method that created the image [16].

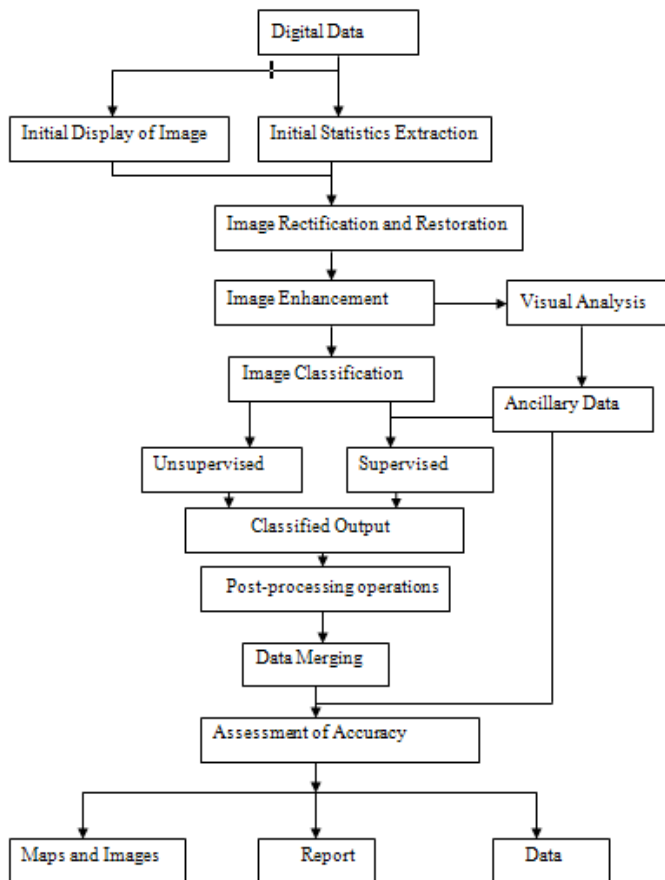
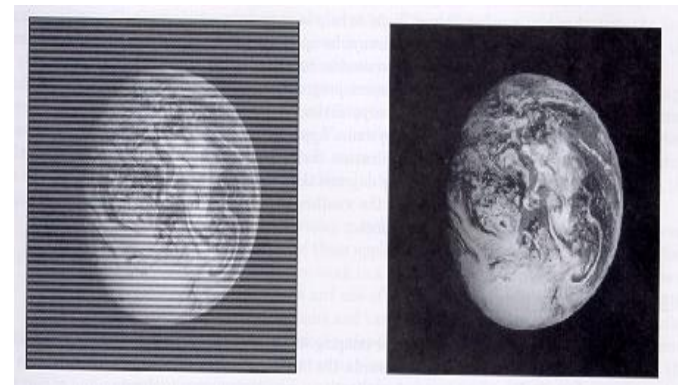
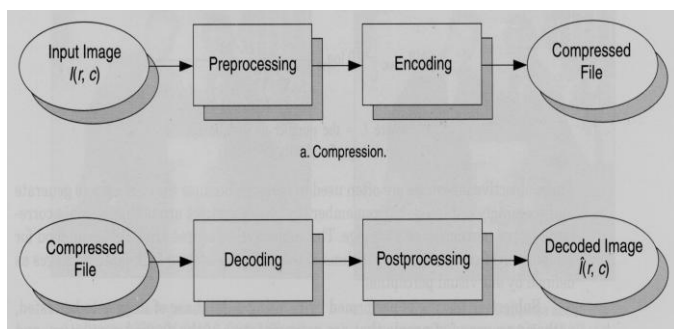


Fig- 2: Flowchart of Image Processing Progression [6].

## 2.3 Image Compression

The objective of image compression is to decrease insignificance and idleness of the image data in order to be able to store or transmit data in incompetent form. Image compression may be lossy. Lossless density is favored for archival reasons and frequently for medical image processing, technical drawings, clipart or comics. Lossy compression techniques, particularly when used at short-bit rates, introduce compression artifacts. Lossy methods are especially fitting for normal images such as snaps in appliances where slight sometimes unnoticeable loss of loyalty is suitable to attain an extensive decline in bit rate. The lossy compression which constructs unnoticeable differences may be called visually lossless [2].



## 2.4 Character Recognition

Optical Character appreciation, usually abbreviated to OCR, is the mechanical or electronic alteration of scanned or photo images of typewritten or printed text into machine-encoded i.e., computer-readable text. It is generally used as an appearance of records access from a little kind of original data source, whether papers, invoice, bank statement, receipts, business cards, a number of printed records or mail. It is an ordinary technique of digitizing printed manuscripts such that they can be by electronic means edited, searched, store more closely used in machine processes such as machine translation and displayed online, text-to-speech, key data extraction and text mining. OCR is a meadow of research in intelligence, pattern and computer vision. Early versions required to be automated with images of each character, and functioned on one font at a time. "Intelligent" structures with a great degree of gratitude accuracy for most fonts are now regular. Some marketable methods are skilled of duplicating formatted output that very much resemble the original scanned sheet including columns, images and other non-textual components [14].

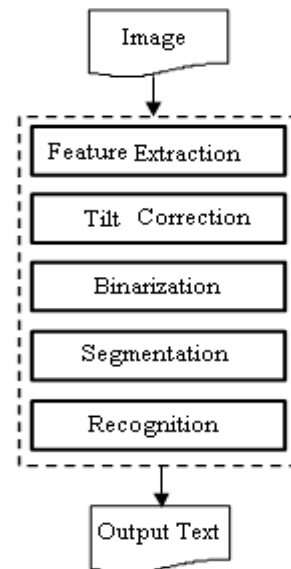


Fig- 3: Flowchart of OCR.

demodulation

demodulation

## 2.5 Signature Verification

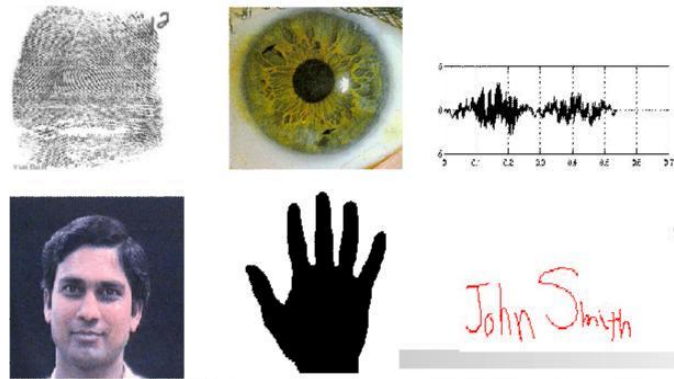
A digital signature is a mathematical scheme for representing the legitimacy of a digital communication. A legal digital signature affords a receiver reason to consider that the message was created by a recognized sender, such that the sender cannot reject having sent the message with non-repudiation and authentication and the message was not changed in transfer. Digital signatures are commonly used for software allocation, financial communication, and in further cases where it is vital to detect imitation or tampering.



## 2.6 Biometrics

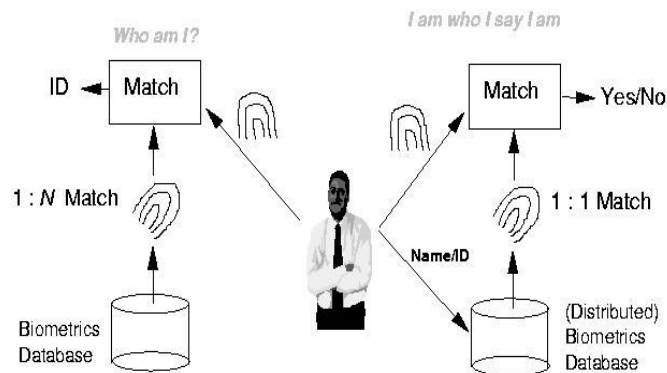
Biometrics (or biometric verification) refers to the automatic identification of humans by their behaviors or characteristics. Biometrics is recycled in computer science as a type of identification and access control. It is also used to recognize individuals in groups that are under surveillance. Biometric identifiers are the exceptional, assessable characteristics used

to label and describe individuals. Biometric identifiers are habitually classified as physiological versus behavioral characteristics. Physiological uniqueness is related to the nature of the body. Few examples includes fingerprint, face recognition, Palm print, DNA, hand geometry, iris recognition, retina and odor/smell. Behavioral characteristics are related to the pattern of performance of a person, including but not limited to typing rhythm, voice and gait. Some researchers have coined the term behavior metrics to describe the latter class of biometrics.



**2.7 Fingerprint Verification / Identification**

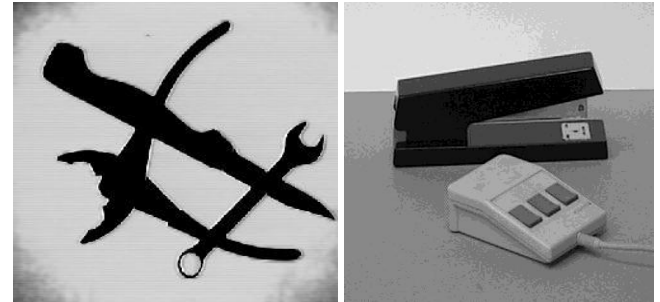
The Fingerprint Verification antagonism (FVC) is an intercontinental competition focused on fingerprint verification software assessment. A subgroup of impressions of fingerprint obtained with different sensors was offered to registered members are allow to adjust the parameters of respective algorithms. Members were appealed to offer enroll and match executable records of their algorithms; the evaluation was carry out at the organizers’ amenities using the submitted effective files on a confiscated database obtained with the identical sensors as the training set.



**2.8 Object Recognition**

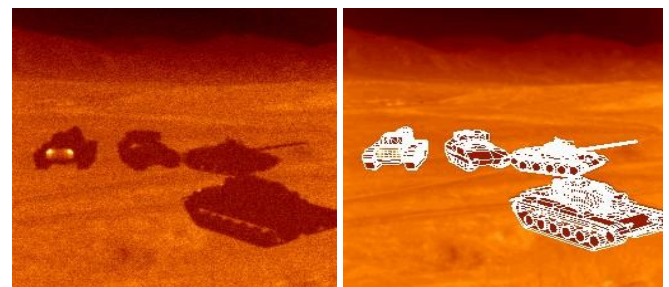
Object detection is a computer technology related to computer vision and image processing that deals with noticing illustrations of semantic objects of a classes such as humans, buildings or cars in digital videos and images. Well-researched

domains of object detection include face detection and pedestrian detection. Object recognition has claims in many areas of computer vision, like image retrieval and video surveillance.



**2.9 Automatic Target Recognition**

Automatic target recognition (ATR) is the skill for an algorithm or device to distinguish objects or targets stand on data gained from sensors. The function of regular target recognition technology is a serious element of robotic warfare. ATR machines are used in unmanned aerial vehicles and cruise missiles. Electric affords an ATRU (Automatic Target Recognition Unit) to the Land Attack Missile of Standoff, which processes post-launch and pre-launch aiming data, allows high quickness in video comparison, and permits the SLAM-ER i.e., Standoff Land Attack Missile - Expanded Response, "Fire-and-forget" missile. The fundamental version of an ATR system is the IFF transponder. Researchers at the University of Illinois at Urbana-Champaign with the support of DARPA have shown that it is possible to build a synthetic aperture radar image(RAD) of an aircraft target using passive multistate, perhaps detailed enough to enable involuntary ATR (Automatic Target Recognition. Other applications of ATR include a proposed security system that uses active UWB radar signals to recognize objects or humans that have dropped onto channel tracks of rail. It is also possible to detect the damaged infrastructures caused by the earthquakes using satellite [10].



**2.10 Traffic Monitoring**

The current disclosure relates to a number of invention heading for, normally to the application of image processing techniques to traffic data acquisition using images/videos. The inventions exist in a system of traffic monitoring, the

fundamental job of which is for acquisition of traffic data and detection of incident. Further distinctively, the application of image processing methods for the vehicle detection, from the series of video images, as well as the acquisition of traffic data and detection of traffic incident. In an individual facet, the present development provides a technique of processing images recognized from a system of traffic monitoring which is video based. In one more feature, the current development is headed to a Region of Interest i.e., ROI for judgment of a vehicle which is moving and a added feature is directed to a technique of detecting day or night position in monitoring a traffic system. It is the application of a variety of algorithms to a traffic monitoring system based on video is also measured imaginative. Other creative characteristic of the present monitoring of traffic system is sketched in the asserts.



**2.11 Face Detection**

Face detection is dependent on computer technology which establishes the sizes and locations of human faces in illogical (digital) images [13]. It detects facial features and ignore such as buildings, bodies and trees. Face recognition can be observed as a more common case of face localization. In face localization, the process is to find the positions and sizes of a known amount of faces. In face recognition, one does not have this supplementary in progression.



**3. MEDICAL APPLICATIONS**

We particularly give the importance to medical imaging as the significant application of image processing. Medical imaging is the method and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures looking for to reveal, diagnose, or examine disease) or medical science (including the study of

physiology and normal anatomy). Although imaging of removed organs and tissues can be performed for medical details, such events are not usually referred to as medical imaging, but somewhat are a part of pathology. As a castigation and in its widest sense, it is part of biological imaging and integrates radiology which uses the imaging technologies of X-ray radiography, magnetic resonance imaging, medical ultra-sonography or ultrasound tactile,, endoscopy, elastography, imaging, thermography, medical and nuclear medicine functional imaging techniques as positron emission tomography. For example consider the detection of tumor in brain which is demonstrated using the flowchart and the images [7].

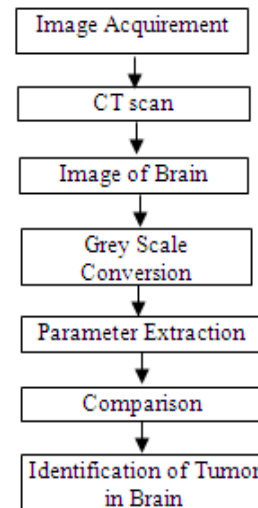


Figure-4: Flowchart for Brain tumor segmentation Process

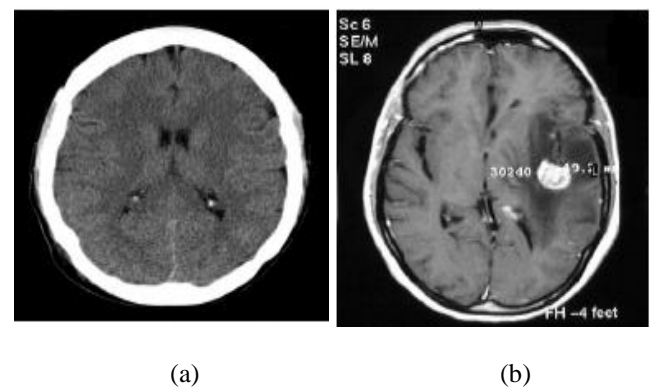


Fig -5: (a) CT scan of normal brain and (b) CT scan of brain containing tumor.

**4. GOALS OF IMAGE PROCESSING**

- The goals of image processing are divided into 5 groups.
1. Hallucination - monitor the objects that are not visible.
  2. Image restoration and sharpening - For creating an better image.

3. Image repositioning - search for the image of interest.
4. Measurement of pattern – Measures a range of objects in an image.
5. Image acknowledgment – differentiate the objects in an image.

## 5. CONCLUSIONS

We have presented a systematic study of image processing and its applications in this paper. We have discussed 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, Visual content analysis, Pattern gratitude, Biometrics, Remote Sensing, Statistical image processing, Multimedia interacting and Virtual reality, face detection and medical image processing. This study will help the researchers working on various fields such as image processing, fault-detection in industrialized Industries, medical image segmentation and also helpful for the students of Electrical, Electronics, Mechanical/AERO/AUTO, Computer Science, IT, and Biomedical.

## 6. REFERENCES

- [1]. Anil K. Jain, A handbook of "Fundamentals of Digital Image Processing", 1989.
- [2]. Rafael C. Gonzalez and Richard E. Woods, A text book on "Digital Image Processing", Publications of Pearson, Second Edition , 2002.
- [3]. M. Petrik and P. Stemberk, "Digital Image Processing Of Structure Response", Engineering Mechanics, 18th International Conference, Pages: 244–245, 2012.
- [4]. H.M. Zelelew, A.T. Papagiannaki and E. Masad, "Application of Digital Image Processing Techniques for Asphalt Concrete Mixture Images", International Association for Computer Methods and Advances in Geo-mechanics (IACMAG) the 12th International Conference, October-2008.
- [5]. D. Maltoni, D. Maio, S. Prabhakar and A. Jain, "Handbook of fingerprint recognition", Publications of Springer, 2002.
- [6]. Dr. D.Vasumathi and M.Upendra Kumar, "Neural Networksbased Development of Digital Image Processing Classification Techniques", IJRIME Volume: 2, April-2012.
- [7]. Nagalkar V.J and Asole S.S, "Brain Tumor Detection Using Digital Image Processing Based on Soft Computing", Signal and Image Processing Journal, Volume: 3, Pages: 102-105, 2012.
- [8]. Jimmy Singla, "Technique Of Image Registration In Digital Image Processing - A Review", International Journal of Information Technology and Knowledge Management, , Volume: 5, Pages: 239-243, July-December 2012.
- [9]. Abou-Bakr M.Ramadan, Mazhar M. Hefnawi , Ahmed M. El-Garhy and Fathy Z.Amer, "Forecasting gamma radiation levels using digital image processing", A Journal on Life Science , Volume: 9, 2012.
- [10]. B.Sreenivas and B.Narasimha Chary, "Processing Of Satellite Image Using Digital Image Processing", A world forum on Geospatial, January - 2011.
- [11]. Shunji Mori, Kazuhiko Yamamoto and Ching Y. Suen "Historical Review of OCR research and development", IEEE Proceedings, Volume: 80, July-1992.
- [12]. Ramakrishna Reddy, G.V.Hari Prasad and Eamani, "Content-Based Image Retrieval Using Support Vector Machine in digital image processing techniques", IJEST, International Journal of Engineering Science and Technology, Volume: 4, April-2012.
- [13]. Faizan Ahmad, Aaima Najam and Zeeshan Ahmed, "Image-based Face Detection and Recognition: State of the Art", IJCSI International Journal of Computer Science Issues, Volume: 9, November-2012.
- [14]. Ayatullah Faruk Mollah, Nabamita Majumder, Subhadip Basu and Mita Nasipuri, "Design of an Optical Character Recognition System for Camera based Handheld Devices", IJCSI International Journal of Computer Science Issues, Volume: 8, July-2011 .
- [15]. S.Arumugam and J.Vijayakumar, "Recognition of Powdery Mildew Disease for Betelvine Plants Using Digital Image Processing", An International Journal of Distributed and Parallel Systems (IJDPS), Volume: 3, March-2012.
- [16]. en.wikipedia.org/wiki/Image\_processing.