



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## Applications of Digital Image Processing

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### Abstract

The extreme flexibility of digital imaging supports a wide range of linear and non-linear processes. The results of this processing are displayed as visualization, intensity and geometric processing, spatial frequency processing, and image analysis. Briefly explained how to perform image processing effectively.

Vision is an important source of human information. It was impossible before, but because of the development of new technologies, it has become possible. The image processing also affects communication equipment. Through digital image processing, we can enhance the image, extract text from the image, define the edges of the image, and apply other effects. There are many digital imaging applications. In practice, this method is used in all fields, including investigations in medicine, robotics, neural networks, and criminal industries.

**Keywords** – Digital, Image, Information, Process, Technology, Recognition.

### I. INTRODUCTION

Digital image processing is the process of performing image processing algorithms on digital images. Digital image processing includes image processing such as image reading, analysis, and manipulation, as well as any type of operation such as rendering of image enhancement information. Process image data for storage, transmission, and presentation. Digital image processing is used in projects for classification, feature extraction, pattern recognition, etc. When processing digital images, the following methods are used: image processing, image restoration, linear filtering, pixelation, point object comparison, principal component analysis, independent component analysis, etc.

Digital imaging is a very popular and rapidly growing field with computer science applications, and its growth is driven by technological innovations in digital imaging, computer processing, and storage devices. Due to its usability and affordability, is now turning to digital systems. Important examples are drug and video production, photography, remote sensing, and security surveillance. In essence, image processing can be defined as the processing of two-dimensional images by a computer. The result of image processing may be the result of the activity of the image or the function or feature associated with the image. The image is

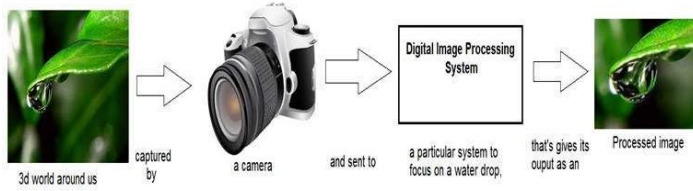
implemented as a two-dimensional signal and a standard signal processing method.

Some important applications of imaging in science and technology include computer vision, remote sensing, feature extraction, face recognition, prediction, optical character recognition, fingerprints, optical classification, reality of controversy, microscopic images, lane departure warning, non-realistic rendering, Medical imaging, and morphological imaging.

### II. WHAT IS IMAGE PROCESSING?

The image is represented as a two-dimensional function  $F(a, b)$ , where  $a$  and  $b$  are space or plane coordinates. The "F" area at each point  $(a, b)$  is called the intensity of the image. at this moment. If  $a$ ,  $b$ , and  $f$  are finite, the image is called a digital image. Digital images are composed of pixels with specific positions and meanings. The pixel value ranges from 0 to 255.

Digital Image Processing (DIP) is software used to process digital images through a computer system. It is also used to enhance the image to obtain important information from it.



Source:

[https://www.tutorialspoint.com/dip/images/introduction\\_image.jpg](https://www.tutorialspoint.com/dip/images/introduction_image.jpg)  
(Fig. 1)

Here are five main types of image processing:

- Display Finding invisible objects in the image.
- Detecting or recognizing any objects in the image.
- Sharpening and restoring the enhanced image from the original image.
- Pattern recognition Measures different patterns of objects around the image.
- Acquisition in Search and search for images similar to the original image in a large digital image database.

### III. EXPLAIN IMAGE PROCESSING

Image processing is defined as a technique that uses a variety of video sensors to enhance the captured original image and is used in various applications, such as medical imaging, film industry, intelligent transportation, and so on. To apply image processing technology, the first step is to digitize the image into an image. In addition, techniques are used to rearrange parts of the image, improve color separation, and improve quality.

Image processing help:

- Improve the digital information we hold.
- Automation of image work.
- Better image optimization for efficient storage and transmission.

Over the years, machine vision has been greatly improved, and many modern commercial machine vision applications have emerged.

### IV. APPLICATIONS OF DIGITAL IMAGE PROCESSING

Digital imaging has had a huge impact in almost every field, and it continues to evolve with the emergence of new technologies.

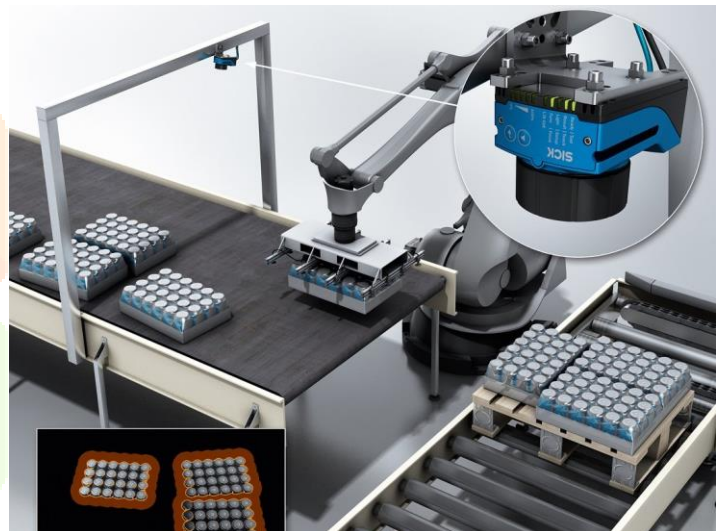
#### 1) Image Sharpening and Restoration

Refers to the process by which we can change the appearance of an image. It mainly processes images and achieves the desired effect. Including image conversion, sharpening, blurring, edge detection, restoration, and detection.

#### 2) Robot Vision

Robot Vision combines camera hardware and computer algorithms to enable robots to process vision data from the world. Various robotic machines are engaged in digital image processing. The robot finds its way through image processing technology. If there is no digital image processing in the robot. it's completely blind.

There are several types of robots that can perform digital image processing. For example, using image processing technology, the robot can find the path to the obstacle detection root and the robot following the line.



Source:

[https://packagingeurope.com/downloads/4325/download/SICK2\\_250618.jpg?cb=bb1ce998de2b8891c835a073e8614162&w=1080](https://packagingeurope.com/downloads/4325/download/SICK2_250618.jpg?cb=bb1ce998de2b8891c835a073e8614162&w=1080)

(Fig. 2)

Robots use vision to perform complex tasks in a constantly changing environment. Digital camera technology is extremely advanced and can move high-resolution pixel arrays on robotic computers. Digital image processing algorithms complement and interpret these images.

#### 3) Medical

There has a variety of applications in the medical field that rely on the performance of digital imaging.

- Gamma-ray image
- PET
- X-ray image
- Medical computed tomography

- UV image

#### 4) Video Processing

This is also one of the applications of digital photo processing. Organize a collection of frames or pictures so that the pictures move quickly. It includes frame rate conversion, motion detection, and noise reduction. Color space conversion, etc.

Video processing is a unique form of signal processing, especially image processing, where video filters are often used, and the input and output signals are video files or video sequences. The video processing technology is commonly used in TVs, VCRs, DVDs, video codecs, video players, video, and other devices.

#### 5) Broadcasting and Encoding

Now, with the advancement of technology, we can display real-time video broadcasting or real-time images from CCTV cameras anywhere in the world in a few seconds. This not only greatly improved the transmission, but also improved the encoding of the images: various high-bandwidth or low-bandwidth formats were developed to encode the images and then transmit them over the Internet.

Digital image transmission is the acquisition of microscopic images, which show the intensity of light or radiation passing through the sample, and are generated by methods such as optical microscopy or transmission electron microscopy. Reduce the amount of data required to render a digital image by deleting unnecessary data, so that the digital image processing is completed and the image is ready to be sent.

#### 6) Color Processing

Digital color image contains the color information of each pixel. A color image has three values for each pixel, and they calculate the intensity of light and color saturation. The information stored in the digital image data is information about the brightness of each shadow. It also includes studying the transmission, storage, and coding of these color images.

#### 7) Pattern Recognition

It includes the research of image processing, combined with artificial intelligence, which can easily realize computer diagnosis, handwriting recognition, and image recognition. Today, image processing is used for pattern recognition.

### V. ADVANTAGES OF IMAGE PROCESSING

The introduction of machine vision technology has had a huge impact on many technology companies. Regardless of the application, some of the most beneficial advantages of image processing:

- Digital images can be accessed in any desired format (image enhancement, X-ray, photographic negative, etc.).
- Helps to improve the image for human interpretation.
- Information can be processed.
- Image pixels can be processed to any desired density and contrast.
- Images can be easily stored and retrieved.
- Images can be easily transferred to electronic devices by external suppliers.

### VI. CONCLUSION

Digital image processing enables digital computers to process digital images. Generally, the image processing helps to create a computer system capable of image processing. Digital Imaging includes powerful intelligent systems and robots that are jointly automated by researchers around the world. It contains advancements in various digital imaging applications.

Nowadays, digital imaging offers many advantages, enabling people to take full advantage of technology and visual effects.

### VII. ACKNOWLEDGMENT

The authors are thankful to all the friends and Faculty of Vivekanand College Kolhapur for motivating us to write this paper. All the references are hereby acknowledged used in this paper.

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