

Applications and Usage

https://www.tutorialspoint.com/dip/applications_and_usage.htm

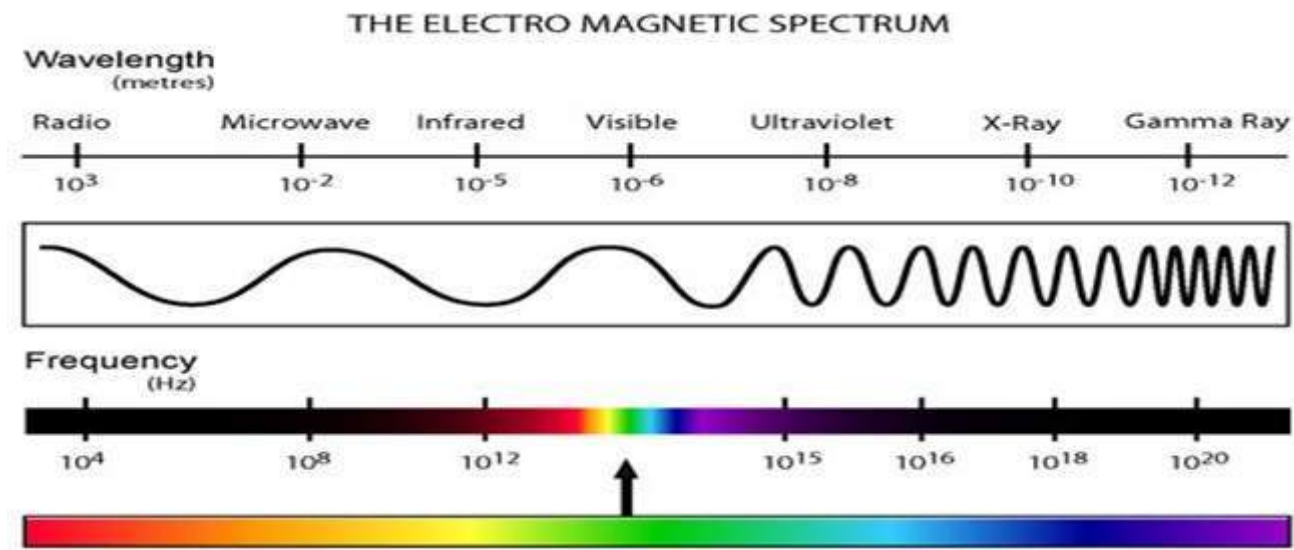
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Since digital image processing has very wide applications and almost all of the technical fields are impacted by DIP, we will just discuss some of the major applications of DIP.

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, e.t.c. Rather it is far more than that.

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.

The electromagnetic spectrum according to the energy of photon is shown below.



In this electromagnetic spectrum, we are only able to see the visible spectrum. Visible spectrum mainly includes seven different colors that are commonly term as *VIBGOYR*. VIBGOYR stands for violet , indigo , blue , green , orange , yellow and Red.

But that doesnot 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 , e.t.c. Hence the analysis of all that stuff too is done in digital image processing.

This discussion leads to another question which is

why do we need to analyze all that other stuff in EM spectrum too?

The answer to this question lies in the fact, because that other stuff such as XRay has been widely used in the field of medical. The analysis of Gamma ray is necessary because it is used widely in nuclear medicine and astronomical observation. Same goes with the rest of the things in EM spectrum.

Applications of Digital Image Processing

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

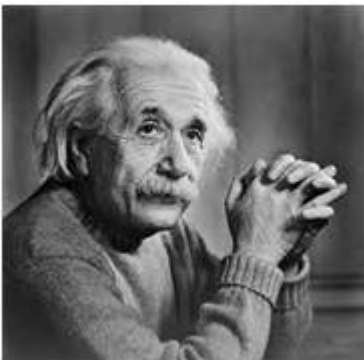
- Image sharpening and restoration
- Medical field
- Remote sensing
- Transmission and encoding
- Machine/Robot vision
- Color processing
- Pattern recognition
- Video processing
- Microscopic Imaging
- Others

Image sharpening and restoration

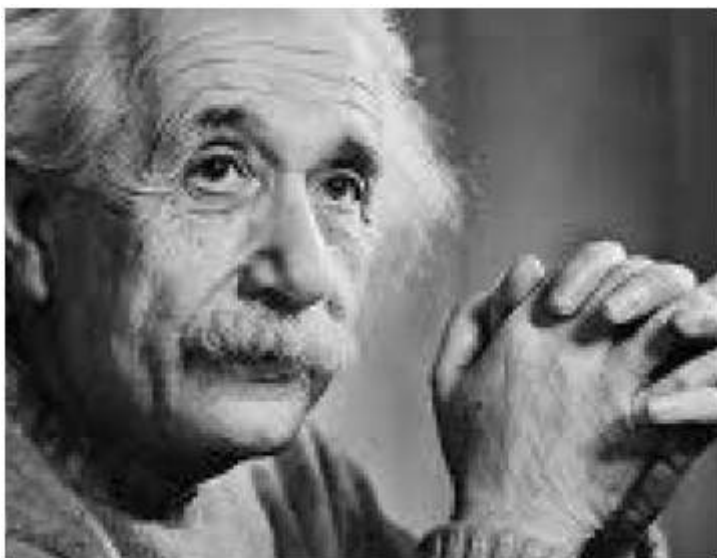
Image sharpening and restoration refers here to process images that have been captured from the modern camera to make them a better image or to manipulate those images in way to achieve desired result. It refers to do what Photoshop usually does.

This includes Zooming, blurring , sharpening , gray scale to color conversion, detecting edges and vice versa , Image retrieval and Image recognition. The common examples are:

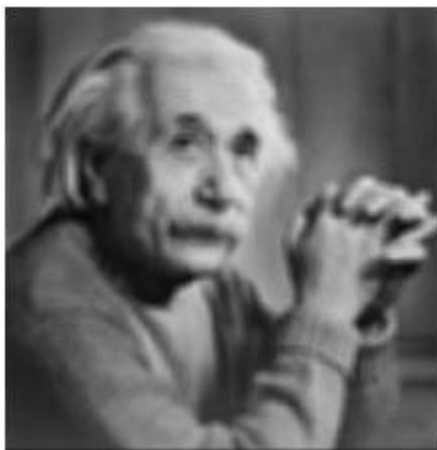
The original image



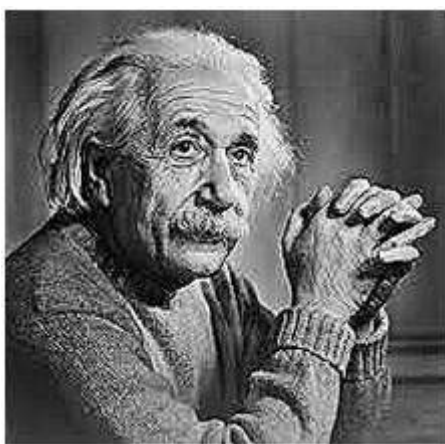
The zoomed image



Blurr image



Sharp image



Edges



Medical field

The common applications of DIP in the field of medical is

- Gamma ray imaging
- PET scan
- X Ray Imaging
- Medical CT
- UV imaging

UV imaging

In the field of remote sensing , the area of the earth is scanned by a satellite or from a very high ground and then it is analyzed 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 , then it is very hectic and time consuming procedure. So a solution to this is found in digital image processing. An image of the effected area is captured from the above ground and then it is analyzed to detect the various types of damage done by the earthquake.



The 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 that was sent is shown below.



The picture that was sent took three hours to reach from one place to another.

Now just imagine , that today we are 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 doesnot 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 or e.t.c.

Machine/Robot vision

Apart form the many challenges that a robot face today , one of the biggest challenge still is to increase the vision of the robot. Make robot able to see things , identify them , identify the hurdles e.t.c. Much work has been contributed by this field and a complete other field of computer vision has been introduced to work on it.

Hurdle detection

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



Line follower robot

Most of the robots today work by following the line and thus are called line follower robots. This help a robot to move on its path and perform some tasks. This has also been achieved through image processing.



Color processing

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

Pattern recognition

Pattern recognition involves study from image processing and from various other fields that includes machine learning *abranchofartificialintelligence*. In pattern recognition , image processing is used for identifying the objects in an 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 , recognition of images e.t.c

Video processing

A video is nothing but just 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 , color space conversion e.t.c.