SYNOPSIS PRESENTATION ON
DIGITAL IMAGE ENHANCEMENT

A leading area in the field of computer graphics and image processing

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TOPICS TO DISCUSS

TITLE OF DISSERTATION
WHAT IS DIGITAL IMAGE PROCESSING
WHY DIGITAL IMAGE PROCESSING IS NECESSARY
APPLICATION AREA
STEPS IN IMAGE PROCESSING
IMAGE ENHANCEMENT
DISSERTATION CATEGORY
HARDWARE AND SOFTWARE REQUIREMENT
FUTURE SCOPE AND ENHANCEMENT
Study and Analysis of digital Image Enhancement Technique
One picture is worth more than ten thousand words.

Anonymous

Interest in digital image processing methods stems from two principal application areas: the improvement of pictorial information for human interpretation and the processing of image data for storage, transmission and representation for autonomous machine perception.
DIGITAL IMAGE PROCESSING
An image may be defined as a two-dimensional function, $f(x,y)$, where $x$ and $y$ are known as spatial coordinates and function $f$ for a particular pair $(x, y)$ is called the intensity or gray level of the image at that point.

A digital image is composed of a finite number of elements, each of which has a particular location and value.

$$\text{Location} = (x, y)$$

$$\text{Value} = f(x,y)$$

These elements are called picture elements, image elements, pels, and pixels. Pixel is the term used most widely to denote the elements of a digital image.
Digital image processing refers to the processing of digital images by means of a digital computer by applying some function to change the value \( f(x,y) \) of the pixel to obtain a different function value.
When represented as discrete form / numbers, brightness can be added, subtracted, multiplied, divided, and i.e. the image can be manipulated, which was not possible if the image was represented as a photograph.

Low contrast  Medium contrast  High contrast
WHY
DIGITAL IMAGE PROCESSING

Find answers here!
We humans are limited to the visual band of the electromagnetic (EM) spectrum.

Machines imaging is needed that cover almost the entire EM spectrum, ranging from gamma to radio waves. They can operate on images generated by sources that humans are not accustomed to associating with images. These include ultrasound, electron microscopy, and computer-generated images.
Machine generated imaging may not always be of good quality or we may be interested only in some of the region of the image or some distortion may occur.

If the images are left distorted, it would render any data extraction from the distorted image.
APPLICATION AREAS
MEDICAL DIAGNOSIS

Gamma-Ray Imaging

Computer vision

Angiography

X-Ray Imaging

Optical sorting

Remote sensing

Pollution patterns

Exploration geophysics

Detection of minerals

Aerial traffic control

Feature detection

Microscope image processing

Detection of land usage

Deforestation

Health of indigenous plants

Automobile industry

Machine vision

Biology
STEPS IN IMAGE PROCESSING
Outputs of these processes generally are images.

Chapter 2: Image acquisition

Chapter 3 & 4: Image filtering and enhancement

Chapter 5: Image restoration

Chapter 6: Color image processing

Chapter 7: Wavelets and multi-resolution processing

Chapter 8: Compression

Chapter 9: Morphological processing

Chapter 10: Segmentation

Chapter 11: Representation & description

Chapter 12: Object recognition

Problem domain

Knowledge base
The aim of image enhancement is to improve the interpretability or perception of information in images for human viewers, or to provide 'better' input for other automated image processing techniques.

Image enhancement techniques can be divided into:

- **Spatial domain methods**, which operate directly on pixels
- **Frequency domain methods**, which operate on the Fourier transform of an image.
Image is NOT Perfect Sometimes
Grey scale manipulation

The simplest form of operation is when the operator $T$ acts only on a $1 \times 1$ pixel neighborhood in the input image, that is $T F(x,y)$ depends on the value of $F$ only at $(x, y)$. This is a grey scale transformation or mapping also known as point to point operation. In this case any pixel with a grey level below the chosen threshold in the input image gets mapped to 0 in the output image and Other pixels are mapped to 255.
Histogram Equalization

Histogram of an image represents the relative frequency of occurrence of various gray levels in the image.

Suppose an image is predominantly dark. Then its histogram would be skewed towards the lower end of the grey scale and all the image detail is compressed into the dark end of the histogram.
Histogram information reveals that image is under-exposed
Application (I): Digital Photography

Application (II): Iris Recognition
NOISE AND NOISE REDUCTION

Noise are the fluctuations caused by thermal energy. Noise fluctuations are rapid and are high frequency.

Filtering in the frequency domain is a common image and signal processing technique. It can smooth, sharpen, de-blur, and restore some images.

There are three basic steps to frequency domain filtering:

The image must be transformed from the spatial domain into the frequency domain using the Fast Fourier transform.

The resulting complex image must be multiplied by a filter (that usually has only real values).

The filtered image must be transformed back to the spatial domain.
LOW PASS FILTERS
HIGH PASS FILTER
MEAN FILTER
MEDIAN FILTER
MID FILTER
MAXIMUM FILTER
MINIMUM FILTER
ALPHA TRIMMED MEAN FILTER
ALPHA COMPLEMENTARY TRIMMED MEAN FILTER
RANGE FILTER
GEOMETRIC MEAN FILTER
HARMONIC MEAN FILTER
POWER MEAN FILTER
There is a broad area of dissertation as provided by the esteemed university. This topic “Digital Image Enhancement” focuses on different techniques that are used for image processing/image enhancement. The word digital emphasizes the processing of digital image by using digital computers. Digital images composed of finite no. of elements and the processing /enhancement function is applied on these elements only.

This project comes under the category of

*Digital Image Processing and Computer graphics*

This gives a detailed study and analysis of different image enhancement techniques.
HARDWARE AND SOFTWARE REQUIREMENT

TECHNOLOGIES USED:

C PROGRAMMING LANGUAGE
VISUAL C++ 6.0 IDE
Windows 98/NT/2000/XP/Windows 7

HARDWARE REQUIREMENT:

Intel Pentium IV Processor or above
RAM size 512 MB minimum.
Hard Disk 40 GB minimum.
FUTURE SCOPE AND FURTHER ENHANCEMENT

This project gives detailed analysis of the image properties and image enhancement techniques. As image processing is a vast area and new technologies are gradually evolving day by day, the future scope is very bright for this topic. This can be associated with different other areas such as:

- Pattern recognition
- Machine learning
- Virtual security
- Robotics e.t.c
Thank you