1.1 Introduction and Definition:

A digital image is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels, elements, each of which has a particular location. For each pixel, there is an associated number known as Digital Number (DN) or sample, which dictates the color and brightness for that particular pixel. An image may be defined as a two-dimensional function, \( f(x,y) \), where ‘x’ and ‘y’ are spatial (plane) coordinates, and the amplitude of ‘f’ at any pair of coordinates \((x,y)\) is called the intensity or gray level of the image at that point.

“Digital image processing” is the technology of applying a number of computer algorithms to process digital images. The outcomes of this process can be either images or a set of representative characteristics or properties of the original images.

What is digital image proceeding?

Digital image processing deals with the manipulation and analysis of pictures by a computer. It can

- Improve Pictorial information for better clarity (human interpretation).
- Automatic machine processing of scene data (interpretation by a machine/non-human, storage, transmission).

1.2. Application Areas of Digital Image Processing:

Today there is almost no area of technical endeavor that is not impacted in some way by digital image processing. We can cover only a few of there applications in the context and space of the current discussion. In general, the fields that use digital image processing techniques can be divided into criminology, morphology, microscopy, photography, remote sensing, medical imaging, forensics, transportation and military application but not limited to.
1.2.1 Criminology / Forensics:

Few types of evidence are more incriminating than a photograph or videotape that places a suspect at a crime scene. Ideally, the image will be clear, with all persons, settings, and objects reliably identifiable. Unfortunately, though, that is not always the case, and the photograph or video image may be grainy, blurry, of poor contrast, or even damaged in some way. In such cases, investigators may rely on computerized technology that enables **digital processing and enhancement** of an image. The U.S. government, and in particular, the military, the FBI, and the National Aeronautics and Space Agency (NASA), and more recently, private technology firms, have developed advanced computer software that can dramatically improve the clarity of and amount of detail visible in still and video images.

1.2.2 Medical Imaging:

This is a technology that can be used to generate images of a human body (or part of it). These images are then processed or analyzed by experts, who provide clinical prescription based on their observations. Ultrasonic, X-ray, Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) are quite often seen in daily life, though different sensory systems are individually applied.

1.2.3 Remote Sensing:

This is technology of employing remote sensors to gather information about the Earth. Usually the techniques used to obtain the information depend on electromagnetic radiation, force fields, or acoustic energy that can be detected by cameras, radiometers, lasers, radar systems, sonar seismographs, thermal meters, etc.

1.2.4 Military:

This area has been overwhelmingly studied recently. Existing applications consist of object detection, tracking and three dimensional reconstructions of territory, etc. For example, a human body or any subject producing heat can be
detected in night time using infrared imaging sensors. This technique has been commonly used in the battle fields. Another example is that three dimensional recovery of a target is used to find its correspondence to the template stored in the database before this target is destroyed by a missile.

1.2.5 Transportation:

This is a new area that has just been developed in recent years. One of the key technological progresses is the design of automatically driven vehicles, where imaging systems play a vital role in path planning, obstacle avoidance and servo control. Digital image processing has also found its applications in traffic control and transportation planning, etc.

1.2.6 Industrial inspection/ quality control:

A major area of digital image processing is in automated visual inspection of manufactured goods. A system has a controller board for a CD_ROM drive. A typical image processing task with products like this is to inspect them for missing parts. Detecting anomalies like there is a major theme of industrial inspection that includes other products such as wood and cloth.

1.2.7 Digital Camera Images:

Digital cameras generally include dedicated digital image processing chips to convert the raw data from the image sensor into a color-corrected image in a standard image file format. Images from digital cameras often receive further processing to improve their quality, a distinct advantage that digital cameras have over film cameras. The digital image processing typically is executed by special software programs that can manipulate the image in many ways.

Many digital cameras also enable viewing of histograms of images, as an aid for the photographer to understand the rendered brightness range of each shot more readily.
1.2.8 Morphology:

The word morphology commonly denotes a branch of biology that deals with the form and structure of animals and plants. We use this image processing under the context of mathematical morphology as a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons and the convex hull. The language of mathematical morphology is Set theory. Sets in this represent the shapes of objects in an image.

1.2.9 Computer Vision:

Computer vision is the science and technology of machines that see, where see in this case means that the machine is able to extract information from an image that is necessary to solve some task. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner.

Examples of application of computer vision include system for:

- Controlling Process (e.g., for indexing databases of images and image sequences).
- Detecting events (e.g., for visual surveillance or people counting).
- Organizing information (e.g., for indexing databases of images and image sequences).
- Modeling objects or environments (e.g., industrial inspection, medical image analysis or topographical modeling).
- Interaction (e.g., as the input to device for computer-human interaction).

Computer vision is, in some ways, the inverse of computer graphics. While computer graphics produces image data from 3D models, computer vision often produces 3D models from image data.
1.2.10 Augmented Reality:

Augmented reality (AR) is a term for a live direct or indirect view of a physical, real-world environment whose elements are augmented by computer-generated sensory input, such as sound or graphics. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented), by a compute. As a result, the technology functions by enhancing one’s current perception of reality. By contrast, virtual reality replaces the real-world with a simulated one.

1.2.11 Non-Photorealistic Rendering:

Non-photorealistic rendering (NPR) is an area of digital image processing that focuses on enabling a wide variety of expressive styles for digital art. In contrast to traditional computer graphics, which has focused on photorealism, NPR is inspired by artistic styles such as painting, drawing, technical illustration, and animated cartoons. NPR has appeared in movies and video games in the form of “toon shaders,” as well as in architectural illustration and experimental animation. An example of a modern use of this method is that of Cel-shaded animation.

There are a number of others applications of digital image processing. Face recognition, iris recognition, speaker recognition and finger print classification etc can be seen in daily routine life. Digital watermarking is used in image and data security. Medical image processing refers to X-ray, sonography, image enhancement, 3-D image reconstruction. On line inspection of industrial parts is applied in industry. The remotely sensed data is captured through multispectral camera, e.g., images of crops are analyzed and watermarking sequence is found using remotely sensed images. We can say about digital image processing is that “future is here”.

1.3 Difference between Image proceeding and Computer Graphics:

There is always a confusion among the newbie’s about the difference between Image Processing and Computer Graphics. Unless specifically mentioned, Computer Graphics is all about Synthesizing a new image from
Geometry, Lighting parameter, Materials and Textures. The Emphasis is on Digital Image Synthesis.

Image processing is the process of manipulating an image acquired through some device. The image too often will be acquired from photographs, scanners, medical equipments. The emphasis is on Analysis and Enhancement of the image. Computer Vision is an area where Image Analysis is used a lot. Raster Operations dominate in the case of image processing. In the case of Computer Graphics, you will mix vector and raster operations to generate the final image.

The key element that distinguishes image processing (or digital image processing) from computer graphics is that image processing generally begins with images in the image space and performs pixel-based operations on them to produce new images that exhibit certain desired features. For example, we may reset each pixel in the image displayed on the monitor screen to its complementary color (e.g., black to white and white to black), turning a dark triangle on a white background to a white triangle on a dark background, or vice versa. While each of these two fields has its own focus and strength, they also overlap and complement each other. In fact, stunning visual effects are often achieved by using a combination of computer graphics and image processing techniques.

1.4 **Fundamental Steps in Digital Image Processing:**

The fundamental steps in image processing are:

- Image acquisition
- Preprocessing
- Segmentation
- Representation and description
- Recognition and interpretation

1.4.1 **Image Acquisition:**

The first step in this process is to acquire a digital image. To do so, it requires an imaging sensor and the capability to digitize the signal produced by
the sensor. The imaging sensor could also be a line-scan camera that produces a single image line at a time. In this case the object motion past the line scanner produces a 2-dimensional image. If the output of the camera or other imaging sensor is not already in digital form an analog to digital converter digitizes it.

Two elements are required to acquire digital images. They are

- A Physical device that is sensitive to a band in the electromagnetic energy spectrum (such as the X-ray, ultra violet, Visible or Infrared bands) and that produces an electrical signal output proportional to the level of energy sensed.
- The Digitizer is a device for converting the electrical output of the physical sensing device into digital form.

Image digitations is achieved by feeding the video output of the cameras into a digitizer as stated earlier which converts the given input to its equivalent digital form.

1.4.2 Image Processing:

After a digital image has been obtained, the next step deals with preprocessing of the image. The key function of preprocessing is to improve the image in ways that increase the chances for success of other processes. It typically deals with techniques for enhancing contrast, removing noise and isolating regions whose texture indicate a livelihood of alphanumeric information. The three main categories of digital image processing are image compression, image enhancement and restoration, and measurement extraction. Image compression is a mathematical technique used to reduce the amount of computer memory needed to store a digital image. The computer discards some information, while retaining sufficient information to make the image pleasing to the human eye. Image enhancement techniques can be used to modify the brightness and contrast of an image, to remove blurriness, and to filter out some of the noise. Using mathematical equations called algorithms the computer applies each change to either the whole image or targets a particular portion of the image. The principal objective of enhancement technique is to process the
image so that the result is more suitable than the original image for specific application. In Image Measurement, the aim is to extract information about the distribution of the size of the objects. This usually involves segmenting the image to separate the objects of interest from the background.

1.4.3 Segmentation:

The first step in image analysis generally is to segment the image. Segmentation subdivides an image into its constituent parts or objects. The level to which this subdivision is carried depends on the problem being solved. That is, segmentation should stop when the objects of interest in an application have been isolated. In general autonomous segmentation is one of the most difficult tasks in image processing.

1.4.4 Representation and Description:

Representation and description almost always follow the output of a segmentation stage, which usually is raw pixel data, constituting either the boundary of a region (i.e., the set of pixels separating one image region from another) or all the points in the region itself. In either case, converting the data to a form suitable for computer processing is necessary. The first decision that must be made is whether the data should be represented as a boundary or as a complete region. Boundary representation is appropriate when the focus is on external shape characteristics, such as corners and inflections. Regional representation is appropriate when the focus is on internal properties, such as texture or skeletal shape. In some applications, these representations complement each other. Choosing a representation is only part of the solution for transforming raw data into a form suitable for subsequent computer processing. A method must also be specified for describing the data so that features of interest are highlighted. Descriptions, also called feature selection, deals with extraction attributes the result in some quantitative information of interest or are basic for differentiating one class of objects from another.
1.4.5 **Recognition and Interpretation:**

Recognition is the process that assigns a label to an object based on the information provided by its descriptors. Interpretation involves assigning meaning to ensemble of recognized objects. In terms of example, identifying a character as, say, a ‘c’ requires associating the descriptors for that character with the label c. we conclude the coverage of digital image processing by developing several techniques for recognition and interpretation.

1.5 **The Storage and Capture of Digital Images:**

Almost all graphics software deals with some “real” images that are captured using digital cameras or flatbed scanners. This section deals with the practicalities of acquiring, storing and manipulating such images.

Images are stored in computers as a 2-dimensional array of numbers. The numbers can correspond to different information such as color or gray scale intensity, luminance, chrominance, and so on.

Before we can process an image on the computer, we need the image in digital form. To transform a continuous tone picture into digital form requires a digitizer. The most commonly used digitizers are scanners and digital cameras. The two functions of a digitizer are sampling and quantizing. Sampling captures evenly spaced data points to represent an image. Since there data points are to be stored in a computer, they must be converted to a binary form. Quantization assigns each value a binary number.

Any image from a scanner, or from a digital camera, or in a computer, is a digital image. Computer images have been “digitized”, a process which converts the real world color picture to instead be numeric computer data consisting of rows and columns of millions of colors samples measured from the original picture.

The way a digital camera creates this copy of a color picture is with a CCD chip behind the lens, constructed with a grid of many tiny light-sensitive
cells, or sensors, arranged to divide the total picture area into rows and columns of a huge number of very tiny sub areas. A 3 mega pixel camera CCD has a grid of 2048x1536 sensors (3 million of them). Each sensor samples the color of one of those tiny areas, crating an image of size 2048x1536 pixels.

A scanner has a one-row array of similar cells, and a motor moves this row of sensors down the page making columns to form the full grid.

In either case, the color and brightness of each tiny area seen by a sensor is “sampled”, meaning the color value of each area is measured and recorded as a numeric vale which represents the color there. This process is called digitizing the image. The data is organized into the same rows and columns to retain the location of each actual tiny picture area.

Each one of these sampled numeric color data values is called a pixel. Pixel is a computer word formed from Picture Element, because a pixel is the smallest element of the digital image.

In your photo editor program, zoom an image to about 500% size on the screen, and you will see the pixels. The fundamental thing to understand about digital images is that they consist of pixels, and are dimensioned in pixels.

It may help to realize that a picture constructed of colored mosaic tile chips on a wall or floor is a somewhat similar concept, being composed of many tiny tile areas, each represented by a sample of one color. From a reasonable viewing distance, we do not notice the individual small tiles, our brain just sees the overall picture represented by them. The concept of pixels is similar, except that these pixels (digitized color sample values) are extremely small, and are aligned in perfect rows and columns of tiny squares, to compose the rectangular total image. A pixel is the remembered color value of each one of these color samples representing tiny square areas. The size of the image is dimensioned in pixels, X columns wide and Y rows tall.
When all of this image data (millions of numbers representing tiny color sample values, each called a pixel) is recombined and reproduced in correct row and column order on printed paper or a computer screen, our human brain recognizes the original image again.

1.6 Basic digital image processing techniques:

There exists thousands of technique to enhance the quality of digital image. Here we will discuss some of them that are widely used in our work.

1.6.1 Anti-Aliasing:

Anti-aliasing is a method for improving the realism of an image by removing the jagged edges from it. These jagged edges, or “jaggies”, appear because a computer monitor has square pixels, and these square pixels are inadequate for displaying lines or curves that are not parallel to the pixels are inadequate for displaying lines or curves that are not parallel to the pixels and other reason is low sampling rate of the image information, which in turn leads to these jaggies. For better understanding, take the following image of darkened circle:

![Darkened Circle Image]

Anti-Aliasing is a method of fooling the eye that a jagged edge is really smooth. Anti-Aliasing is often referred in games and on graphics cards. In games especially the chance to smooth edges of the images goes a long way to creating a realistic 3D image on the screen. Remember though that Anti-Aliasing does not actually smooth any edges of images it merely fools the eye. Like a lot of things they are only designed to be good enough.

There are several algorithms developed for anti-aliasing, the simplest is to increase the resolution. Doubling the resolution in horizontal and vertical direction, will make the jags half in size and double their number. They will look smoother, but this will quadruple the use of graphical memory, which is expensive. There are other and cheaper ways to handle the problem.
“Another Anti-aliasing technique widely used in computer graphics to optimize the look of graphics and typography on the display screen; visually ‘smoothes’ the shapes in graphics and type by inserting pixels of intermediate colors along boundary edges between colors”.

Let’s take a look at the example below to demonstrate the effects of Anti-Aliasing.

The letter on the left is a blown up letter ‘a’ with no anti-aliasing. The letter on the right has had anti-aliasing applied to it. In this blown up form it looks like it is simply blurred but if we reduce the size down to a more standard size you may see the difference.

Now look closely at the two letters. You can still tell that the letter of the left is jagged but the letter on the right looks a lot smoother and less blurry than the example above. Remember I have only shrunk the image down back to normal size and have not altered anything else to the image at all. So as you can see, Anti-Aliasing brings a much more pleasing image to the eye.

**Pro’s and Cons-The Summary**

There are pro’s and cons for using anti-aliasing in both games and applications. We have been through them but here is a quick summery to help you make up your mind if using Anti-Aliasing is right for you and your PC.

**Pro’s**

- Smoothes out screen fonts
- Rounded edges look to have smooth curves
- Type can be easier to read due to better quality fonts
- Games look a lot prettier and more realistic.

**Cons**

- Small objects can be too blurred to read
- Already sharp edges can be made fuzzier
You can’t print out Anti-Aliased text as it blurs.
Static image sizes are larger
Games are affected by lower frame rates

1.6.2 Convolutions:

One of the reasons for capturing an image digitally is to allow us to manipulate it to better serve our needs. Often this will include trying to improve the subjective appearance of an image through smoothing of grainy features or sharpening of indistinct features. These goals sometimes can be accomplished through the use of a “discrete convolution” operation (also called digital filtering).

A convolution lets you do many things, like calculate derivatives, detect edges, apply blurs, etc. A very wide variety of things and all of this is done with a “convolution kernel”.

In general Convolution is a common image processing technique that changes the intensities of a pixel to reflect the intensities of the surrounding pixels. A common use of convolution is to create image filters. Using convolution, you can get popular image effects like blur, sharpen, and edge detection-effects used by applications such as Photo Booth, iPhoto, and Aperture.

But at first we should know that any picture get stored via pixel’s intensity level, as shown in following figure:

Discrete convolution determines a new value for each pixel in an image by computing some function of that pixel and its neighbors. Often this function simply is a weighted sum of pixel values in a small neighborhood of the source pixel. These weights can be represented by a small matrix that sometimes is called a “convolution kernel”. The dimensions of the matrix must be odd so there will be a central cell to represent the weight of the original value of the pixel for which we are computing a new value. The new value is computed by multiplying
each pixel value in the neighborhood of the central pixel by the corresponding weight in the matrix, summing all the weighted values, and dividing by the sum of the weights in the matrix.

The anchor point starts at the top-left corner of the image and moves over each pixel sequentially. At each position, the kernel overlaps a few pixels on the image. Each overlapping pair of numbers is multiplied and added. Finally, the value at the current position is sent to this sum.

The matrix on the left is the image and the one on the right is the kernel. Suppose the kernel is at the highlighted position. So the ‘9’ of the kernel overlaps with the ‘4’ of the image. So you calculate their product: 36. Next, ‘3’ of the kernel overlaps the ‘3’ of the image. So you multiply: 9. Then you add it to 36. So you get a sum of 36+9=45. Similarly, you do for all the remaining 7 overlapping values. You’ll get a total sum. This sum is stored in place of ‘2’ (in the image).

Now, the question that will arise is “from where the convolution kernel or filter matrix comes from?”. Kernel is pre-calculated matrix. Design of kernels is based on high levels mathematics. You can find ready-made kernels on the Web. We will discuss few examples later in this topic.

**Problematic corners and edges**

The kernel is two dimensional. So you have problems when the kernel is near the edges or corners. So we have no idea what to do with it. Usually to compensate them we create extra pixels near the edges. There are a few ways to create extra pixels:

- Set a constant value for these pixels i.e., zero
- Duplicate edge pixels
- Warp the image around (copy pixels from the other end)

This usually fixes the problems that might arise.
Examples:

Design of kernels is based on high levels mathematics. You can find ready-made kernels on the web.

Convolutions are used by many applications for engineering and mathematics. Many types of blur filters or edge detection use convolutions. It is based on the convolution theorem, which states that an enhanced image \( g(x,y) \) can be produced by convolving the image \( f(x,y) \) with an operator \( h(x,y) \).

1.6.3 Thresholding:

Image thresholding is a useful method in many image processing and computer vision applications, especially in image segmentations. It can be used to distinguish object and background pixels in a digital image by their gray-level values. The output of the bi-level thresholding operation is a binary image whose one part indicates the object and the other the background. Image thresholding is one of the most common image processing operations, since almost all image processing schemes need some sort of separation of the pixels into different classes.

Method and Variants:

During the thresholding process, individual pixels in an image are marked as “object” pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as “background” pixels otherwise. This convention is known as “threshold above”. Variants include “threshold below”, which is opposite of threshold above; “threshold inside”, where a pixel is labeled “object” if its value is between two thresholds; and “threshold outside”, which is the opposite of threshold inside. Typically, an object pixel is given a value of “1” while a background pixel is given a value of “0”. Finally, a binary image (image containing white and black color only) is created by coloring each pixel white or black, depending on a pixel’s label.
Threshold Selection:

The key parameter in the thresholding process is the choice of the threshold value. Several different methods for choosing a threshold exist; users can manually choose a threshold value, or a thresholding algorithm can compute a value automatically, which is known as “automatic thresholding”. A simple method would be to choose the mean or median value, the rationale being that if the object pixels are brighter than the background, they should also be brighter than the average. In a noiseless image with uniform background and object values, the mean or median will work well as the threshold, however this will generally not be the case. A more sophisticated approach might be to create a histogram of the image pixel intensities and use the valley point as the threshold. The histogram of an image might be considered as a powerful measure for thresholding since it represents the distribution of the image brightness. The histogram approach assumes that there is some average value for the background and object pixels, but that the actual pixel values have some variation around these average values. How ever may be computationally expensive, and image histograms may not have clearly defined valley points often making the selection of an accurate threshold difficult.

Adaptive Thresholding

Thresholding is called adaptive thresholding when a different threshold is used for different regions in the image. This may also be known as local or dynamic thresholding.
1.7 Review of Literature


[46] I. Kompatsiaris and M. G. Strintzis, “Spa


[113] Imagery library for intelligent detection systems (i-LIDS), [Last accessed: August 2007]


1.8 Motivation

Over the last decades, the rapid rise of information Technology (IT) industry has resulted in significant and continuous increase in the capabilities of the computational hardware with low cost. The growth of the computational power is well characterized by the famous Moore’s law for almost 40 years. The increase of the capacities of storage device: Electronic storage(memory), magnetic storage and optical storage follows.

The advances of sensor technology have also made CCD highly available. All this has opened possibilities for automatic video understanding, which needs to manipulate huge amount of possible real-time data, in the hardware aspect.

The ultimate goal of video understanding is to make structured decomposition of video into the scene, describe the objects and their time-varying properties, and to extract semantic meaning from them. Humans, one of the main objects in the real world, are of special significance since they are the main class of actors of daily life activities of interest. Being able to detect human objects and track their motion in video sequences is not one useful by itself but also a crucial step to higher level analysis.

This technology can enable many applications which will provide information, convenience and security to our lives. The detection and tracking by itself can be used directly for intrusion detection, human counting, and estimation of crowd flow. Its further applications include automatic video which facilitate fighting against crime providing higher level of security, advanced human computer interaction for understanding behaviors for better assistance in various environment, content based video indexing which makes more efficient access of the information from huge volume of video data.

According to the survey mentioned, various algorithms are written and developed to track multiple objects of the same class for a particular related video
format only, but lack with different video format and different object class type. These algorithms have not been check for performance too among themselves.

Survey also states that traced video objects extraction is done using various methods, these methods used to extract object by segregation, segregation of objects are done only to particular class object type. But it lack with extraction of different objects of different class type.

The goal of work is to Track Multiple Generic objects in complex situations of a moving picture, prepare a content based video indexing for tracked objects, Segregate the objects from the content video index or crop the object, Segregated objects are applying for Super Zooming with increase in intensity for better identification. A comparative study of multiple objects tracking algorithm with the proposed and Various Zooming algorithm with the proposed.

The work has been divided into chapters,

In chapter 2, I propose a Multi-Level path scheme for the class of multiple object tracking problems where the inter-object interaction metric is convex and the intra object term quantifying object state continuity may use any metric. The proposed scheme models object tracking as a multi-path searching problem. It explicitly models track interaction, such as object spatial layout consistency or mutual occlusion, and optimizes multiple object tracks simultaneously. The proposed scheme does not rely on track initialization and complex heuristics. It has much less average complexity than previous efficient exhaustive search methods such as extended Generic Multi-level path programming and is found to be able to find the global optimum with high probability. I have successfully applied the proposed method to multiple objects tracking in video streams.

Result:

Track various types of objects in a video scenes or motion picture, with accuracy and less noise
The various areas of application my work can be used:

**Military:**

This area has been overwhelmingly studied recently. Existing applications consist of object detection, tracking and three dimensional reconstructions of territory, etc. For example, a human body or any subject producing heat can be detected in night time using infrared imaging sensors. This technique has been commonly used in the battle fields. Another example is that three dimensional recovery of a target is used to find its correspondence to the template stored in the database before this target is destroyed by a missile.

**Transportation:**

This is a new area that has just been developed in recent years. One of the key technological progresses is the design of automatically driven vehicles, where imaging systems play a vital role in path planning, obstacle avoidance and servo control. Digital image processing has also found its applications in traffic control and transportation planning, etc.

In chapter 3, Video object (VO) extraction is of great importance in multimedia processing. In recent years approaches have been proposed to deal with VO extraction as a classification problem. This type of methods calls for state-of-the-art classifiers because the performance is directly related to the accuracy of classification. Promising results have been reported for single object extraction using Support Vector Machines (SVM) and its extensions. Multiple object extraction, on the other hand, still imposes great difficulty as multi-category classification is an ongoing research topic in machine learning. I introduce a new class of multi-category learning scheme for multiple VO extraction, and demonstrates its effectiveness and advantages by experiments.

Result achieved

Segregation can be done to objects with high accuracy and low noise.
The area of Applications, where my work can be used:

**Morphology:**

The word morphology commonly denotes a branch of biology that deals with the form and structure of animals and plants. We use this image processing under the context of mathematical morphology as a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons and the convex hull. The language of mathematical morphology is Set theory. Sets in this represent the shapes of objects in an image.

**Medical imaging:**

This is a technology that can be used to generate images of a human body (or part of it). These images are then processed or analyzed by experts, who provide clinical prescription based on their observations. Ultrasonic, X-ray, Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) are quite often seen in daily life, though different sensory systems are individually applied.

In Chapter 4, Image zooming is the process of enlarging the image to as desired magnification factor. But while enlarging an image there are few parameters that we have to keep in mind. When the image is zoomed, artifacts like blurring, jagging and ghosting may arise. So the main focus is on the reduction of these artifacts.

My algorithm deals with the edges. It is basically designed to preserve the edges. It’s as adaptive zooming algorithm which focuses on preserving edges. The algorithm reduces the jagging. Blurring is reduced a lot in our algorithm.

Chapter 5, deals with, the non-trivial problem of performance evaluation of motion tracking. I propose a rich set of metrics to assess different aspects of performance of motion tracking. We use six different video sequences that represent a variety of challenges to illustrate the practical value of the proposed
metrics by evaluating and comparing two motion tracking algorithms. The contribution of my framework is that allows the identification of specific weaknesses of motion trackers, such as the performance of specific modules or failures under specific conditions.

In the rest, first summarize pervious work related to different aspect of motion tracking algorithm with the need for generic multiple object tracking algorithm in chapter 2. In chapter 3 present segregations of objects need and proposed algorithm which can segregate generic objects extracted from a multiple objects from content based video images and discuss its merits. In chapter 4, I present a super resolution and zooming algorithm which zooming objects with different variances, comparison of previous with proposed algorithms. In chapter 5, Performance analysis of multiple object tracking algorithm with various factors and live video. At last I summarize my contribution and discuss the future research directions.