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A Review on Image and Video processing

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Abstract

Image and Video Processing are hot topics in the field of research and development. Image processing is any form of signal processing for which the input is an image, such as photographs or frames of video; the output of image processing can be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Video processing is a particular case of signal processing, where the input and output signals are video files or video streams. Video processing techniques are used in television sets, VCRs, DVDs, video codecs, video players and other devices. In This paper, We present Image and Video processing elements. We also present the current technologies related to Image and Video Processing.

Keywords: *Image Processing, Video Processing, Digital Image, Multimedia*

1. Introduction

Image processing usually refers to digital image processing, but optical and analog image processing are also possible. The acquisition of images (producing the input image in the first place) is referred to as imaging. [1] Digital video is a type of video recording system that works by using a digital rather than an analog video signal. The terms camera, video camera, and camcorder are used interchangeably in this article. [2] In the following sections of this paper, we will discuss the elements of Digital Image Processing. We will also discuss the elements of Digital Video Processing. And lastly, we will review the current technologies and techniques in the fields.

2. Digital Image Processing

Digital Images are produced by a variety of physical devices, including still and video cameras, x-ray devices, electron microscopes, radar, and ultrasound, and used for a variety of purposes, including entertainment, medical, business (e.g. documents), industrial, military, civil (e.g. traffic), security, and scientific. The goal in each case is for an observer, human or machine, to extract useful information about the scene being imaged. An example of an industrial application is shown in Figure 1. Often the raw image is not directly suitable for this purpose, and must be

processed in some way. Such processing is called image enhancement; processing by an observer to extract information is called image analysis. Enhancement and analysis are distinguished by their output, images vs. scene information, and by the challenges faced and methods employed. Image enhancement has been done by chemical, optical, and electronic means, while analysis has been done mostly by humans and electronically. [3]

Digital image processing is a subset of the electronic domain wherein the image is converted to an array of small integers, called pixels, representing a physical quantity such as scene radiance, stored in a digital memory, and processed by computer or other digital hardware. Digital image processing, either as enhancement for human observers or performing autonomous analysis, offers advantages in cost, speed, and flexibility, and with the rapidly falling price and rising performance of personal computers it has become the dominant method in use. [3]

An image is not a direct measurement of the properties of physical objects being viewed. Rather it is a complex interaction among several physical processes: the intensity and distribution of illuminating radiation, the physics of the interaction of the radiation with the matter comprising the scene, the geometry of projection of the reflected or transmitted radiation from 3 dimensions to the 2 dimensions of the image plane, and the electronic characteristics of the sensor. Unlike for example writing a compiler, where an algorithm backed by formal theory exists for translating a high-level computer language to machine language, there is no algorithm and no comparable theory for extracting scene information of interest, such as the position or quality of an article of manufacture, from an image. [3]

The challenge is often underappreciated by novice users due to the seeming effortlessness with which their own visual system extracts information from scenes. Human vision is enormously more sophisticated than anything we can engineer at present and for the foreseeable future. Thus one must be careful not to evaluate the difficulty of a digital image processing application on the basis of how it looks to humans. [3]

Perhaps the first guiding principal is that humans are better at judgement and machines are better at measurement. Thus determining the precise position and size of an automobile part on a conveyer, for example, is well-suited for digital image processing, whereas grading apples or wood is quite a bit more challenging (although not impossible). Along these lines image enhancement, which generally requires lots of numeric computation but little judgement, is well-suited for digital processing. [3]

If teasing useful information out of the soup that is an image isn't challenging enough, the problem is further complicated by often severe time budgets. Few users care if a spreadsheet takes 300 milliseconds to update rather than 200, but most industrial applications, for example, must operate within hard constraints imposed by machine cycle times. There are also many applications, such as ultrasound image enhancement, traffic monitoring, and camcorder stabilization, that require real-time processing of a video stream. To make the speed challenge concrete, consider that the video stream from a standard monochrome video camera produces around 10

million pixels per second. As of this writing the typical desktop PC can execute maybe 50 machine instructions in the 100 ns. available to process each pixel. [3]

The set of things one can do in a mere 50 instructions is rather limited. On top of this many digital image processing applications are constrained by severe cost targets. Thus we often face the engineer's dreaded triple curse, the need to design something good, fast, and cheap all at once. [3]



Figure 1. Digital image processing is used to verify the dimensional accuracy and examine the surface for inclusion and defects.

3. Application of Digital Image Processing

Digital Image Processing is applied in the fields of Computer vision, Face detection, Feature detection, Lane departure warning system, Non-photorealistic rendering, Medical image processing, Microscope image processing Morphological image processing, Remote sensing, etc.

3.1 Computer vision

Computer vision is the science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory for building artificial systems that obtain information from images. The image data can take many forms, such as a video sequence, views from multiple cameras, or multi-dimensional data from a medical scanner. [4]

As a technological discipline, computer vision seeks to apply its theories and models to the construction of computer vision systems. Examples of applications of computer vision include systems for:

- Controlling processes (e.g., an industrial robot or an autonomous vehicle).
- 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 a device for computer-human interaction).

Computer vision can also be described as a complement (but not necessarily the opposite) of biological vision. In biological vision, the visual perception of humans and various animals are studied, resulting in models of how these systems operate in terms of physiological processes. Computer vision, on the other hand, studies and describes artificial vision system that is implemented in software and/or hardware. Interdisciplinary exchange between biological and computer vision has proven increasingly fruitful for both fields.

Sub-domains of computer vision include scene reconstruction, event detection, video tracking, object recognition, learning, indexing, motion estimation, and image restoration.

3.1.1 Applications of Computer vision. One of the most prominent application fields is medical computer vision or medical image processing. This area is characterized by the extraction of information from image data for the purpose of making a medical diagnosis of a patient. Generally, image data is in the form of microscopy images, X-ray images, angiography images, ultrasonic images, and tomography images. An example of information which can be extracted from such image data is detection of tumours, arteriosclerosis or other malign changes. It can also be measurements of organ dimensions, blood flow, etc. This application area also supports medical research by providing new information, e.g., about the structure of the brain, or about the quality of medical treatments.

A second application area in computer vision is in industry, sometimes called machine vision, where information is extracted for the purpose of supporting a manufacturing process. One example is quality control where details or final products are being automatically inspected in order to find defects. Another example is measurement of position and orientation of details to be picked up by a robot arm.

Military applications are probably one of the largest areas for computer vision. The obvious examples are detection of enemy soldiers or vehicles and missile guidance. More advanced systems for missile guidance send the missile to an area rather than a specific target, and target selection is made when the missile reaches the area based on locally acquired image data. Modern military concepts, such as "battlefield awareness", imply that various sensors, including image sensors, provide a rich set of information about a combat scene which can be used to support strategic decisions. In this case, automatic processing of the data is used to reduce complexity and to fuse information from multiple sensors to increase reliability.

Artist's Concept of Rover on Mars, an example of an unmanned land-based vehicle. Notice the stereo cameras mounted on top of the Rover. (credit: Maas Digital LLC)

One of the newer application areas is autonomous vehicles, which include submersibles, land-based vehicles (small robots with wheels, cars or trucks), aerial vehicles, and unmanned aerial vehicles (UAV). The level of autonomy ranges from fully autonomous (unmanned) vehicles to vehicles where computer vision based

systems support a driver or a pilot in various situations. Fully autonomous vehicles typically use computer vision for navigation, i.e. for knowing where it is, or for producing a map of its environment (SLAM) and for detecting obstacles. It can also be used for detecting certain task specific events, e. g., a UAV looking for forest fires. Examples of supporting systems are obstacle warning systems in cars, and systems for autonomous landing of aircraft. Several car manufacturers have demonstrated systems for autonomous driving of cars, but this technology has still not reached a level where it can be put on the market. There are ample examples of military autonomous vehicles ranging from advanced missiles, to UAVs for recon missions or missile guidance. Space exploration is already being made with autonomous vehicles using computer vision, e. g., NASA's Mars Exploration Rover. Other application areas include:

- Support of visual effects creation for cinema and broadcast, e.g., camera tracking (matchmoving).
- Surveillance.

3.2 Face detection

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies.

Face detection can be regarded as a specific case of object-class detection; In object-class detection, the task is to find the locations and sizes of all objects in an image that belong to a given class. Examples include upper torsos, pedestrians, and cars.

Face detection can be regarded as a more general case of face localization; In face localization, the task is to find the locations and sizes of a known number of faces (usually one). In face detection, one does not have this additional information.

Early face-detection algorithms focused on the detection of frontal human faces, whereas newer algorithms attempt to solve the more general and difficult problem of multi-view face detection. That is, the detection of faces that are either rotated along the axis from the face to the observer (in-plane rotation), or rotated along the vertical or left-right axis (out-of-plane rotation), or both.

Many algorithms implement the face-detection task as a binary pattern-classification task. That is, the content of a given part of an image is transformed into features, after which a classifier trained on example faces decides whether that particular region of the image is a face, or not.

Often, a window-sliding technique is employed. That is, the classifier is used to classify the (usually square or rectangular) portions of an image, at all locations and scales, as either faces or non-faces (background pattern).

Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and image database management. Some recent digital cameras use face detection for autofocus [6]. Also, face detection is useful for selecting regions of interest in photo slideshows that use a pan-and-scale Ken Burns effect.

3.3 Feature detection

In computer vision and image processing the concept of feature detection refers to methods that aim at computing abstractions of image information and making local decisions at every image point whether there is an image feature of a given type at that point or not. The resulting features will be subsets of the image domain, often in the form of isolated points, continuous curves or connected regions. [7]



Figure 2. Output of a typical corner detection algorithm

There is no universal or exact definition of what constitutes a feature, and the exact definition often depends on the problem or the type of application. Given that, a feature is defined as an "interesting" part of an image, and features are used as a starting point for many computer vision algorithms. Since features are used as the starting point and main primitives for subsequent algorithms, the overall algorithm will often only be as good as its feature detector. Consequently, the desirable property for a feature detector is repeatability: whether or not the same feature will be detected in two or more different images of the same scene.

Feature detection is a low-level image processing operation. That is, it is usually performed as the first operation on an image, and examines every pixel to see if there is a feature present at that pixel. If this is part of a larger algorithm, then the algorithm will typically only examine the image in the region of the features. As a built-in pre-requisite to feature detection, the input image is usually smoothed by a Gaussian kernel in a scale-space representation and one or several feature images are computed, often expressed in terms of local derivative operations.

Occasionally, when feature detection is computationally expensive and there are time constraints, a higher level algorithm may be used to guide the feature detection stage, so that only certain parts of the image are searched for features. [7]

Where many computer vision algorithms use feature detection as the initial step, so as a result, a very large number of feature detectors have been developed. These vary widely in the kinds of feature detected, the computational complexity and the repeatability. At an overview level, these feature detectors can (with some overlap) be divided into the following groups:

- **Edges** - Edges are points where there is a boundary (or an edge) between two image regions. In general, an edge can be of almost arbitrary shape, and may include junctions. In practice, edges are usually defined as sets of points in the image which have a strong gradient magnitude. Furthermore, some common algorithms will then chain high gradient points together to form a more complete description of an edge. These algorithms usually place some constraints on the properties of an edge, such as shape, smoothness, and gradient value. Locally, edges have a one dimensional structure.
- **Corners / interest points** - The terms corners and interest points are used somewhat interchangeably and refer to point-like features in an image, which have a local two dimensional structure. The name "Corner" arose since early algorithms first performed edge detection, and then analysed the edges to find rapid changes in direction (corners). These algorithms were then developed so that explicit edge detection was no longer required, for instance by looking for high levels of curvature in the image gradient. It was then noticed that the so-called corners were also being detected on parts of the image which were not corners in the traditional sense (for instance a small bright spot on a dark background may be detected). These points are frequently known as interest points, but the term "corner" is used by tradition.
- **Blobs / regions of interest or interest points** - Blobs provide a complementary description of image structures in terms of regions, as opposed to corners that are more point-like. Nevertheless, blob descriptors often contain a preferred point (a local maximum of an operator response or a center of gravity) which means that many blob detectors may also be regarded as interest point operators. Blob detectors can detect areas in an image which are too smooth to be detected by a corner detector. Consider shrinking an image and then performing corner detection. The detector will respond to points which are sharp in the shrunk image, but may be smooth in the original image. It is at this point that the difference between a corner detector and a blob detector becomes somewhat vague. To a large extent, this distinction can be remedied by including an appropriate notion of scale. Nevertheless, due to their response properties to different types of image structures at different scales, the LoG and DoH blob detectors are also mentioned in the article on corner detection.

- **Ridges** - For elongated objects, the notion of ridges is a natural tool. A ridge descriptor computed from a grey-level image can be seen as a generalization of a medial axis. From a practical viewpoint, a ridge can be thought of as a one-dimensional curve that represents an axis of symmetry, and in addition has an attribute of local ridge width associated with each ridge point. Unfortunately, however, it is algorithmically harder to extract ridge features from general classes of grey-level images than edge-, corner- or blob features. Nevertheless, ridge descriptors are frequently used for road extraction in aerial images and for extracting blood vessels in medical images -- see ridge detection.

3.4 Lane departure warning system

In road-transport terminology, a lane departure warning system is a mechanism designed to warn a driver when the vehicle begins to move out of its lane (unless a turn signal is on in that direction) on freeways and arterial roads. [8]

The first production lane departure warning system in Europe was the system developed by America's Iteris for Mercedes Actros commercial trucks. The system debuted in 2000 and is now available on most trucks sold in Europe. In 2002, the Iteris system became available on Freightliner Trucks' trucks in North America. In all of these systems, the driver is warned of unintentional lane departures by an audible rumble strip sound generated on the side of the vehicle drifting out of the lane. If a turn signal is used, no warnings are generated.

More effective lane departure warning systems are now combining prevention with risk reports in the transportation industry. Viewnyx applies video based technologies to assist fleets in lowering their driving liability costs. Firstly, by addressing the main causes of collisions: driving error, distraction and drowsiness. Secondly, by providing Safety Managers with driver and fleet risk assessment reports and tools to facilitate proactive coaching & training to eliminate high risk behaviors. The Lookout solution is currently being used by North American fleets. There are two main types of systems:

- systems which warn the driver if the vehicle is leaving its lane.
- systems which warn the driver and if no action is taken automatically take steps to ensure the vehicle stays in its lane.

3.5 Non-photorealistic rendering

Non-photorealistic rendering (NPR) is an area of computer graphics 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.

3.6 Medical image processing

Medical imaging is the technique and process used to create images of the human body (or parts and function thereof) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or medical science (including the study of normal anatomy and physiology).

As a discipline and in its widest sense, it is part of biological imaging and incorporates radiology (in the wider sense), nuclear medicine, investigative radiological sciences, endoscopy, (medical) thermography, medical photography and microscopy (e.g. for human pathological investigations).

Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magnetoencephalography (MEG), Electrocardiography (EKG) and others, but which produce data susceptible to be represented as maps (i.e. containing positional information), can be seen as forms of medical imaging.

3.6.1 Magnetic resonance imaging (MRI). A magnetic resonance imaging instrument (MRI scanner), or "nuclear magnetic resonance (NMR) imaging" scanner as it was originally known, uses powerful magnets to polarise and excite hydrogen nuclei (single proton) in water molecules in human tissue, producing a detectable signal which is spatially encoded, resulting in images of the body. MRI uses three electromagnetic fields: a very strong (on the order of units of teslas) static magnetic field to polarize the hydrogen nuclei, called the static field; a weaker time-varying (on the order of 1 kHz) field(s) for spatial encoding, called the gradient field(s); and a weak radio-frequency (RF) field for manipulation of the hydrogen nuclei to produce measurable signals, collected through an RF antenna. [9]

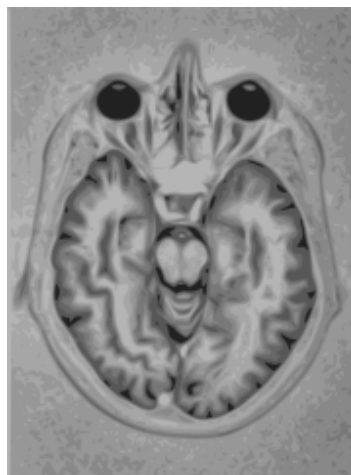


Figure 3. A brain MRI representation

Like CT, MRI traditionally creates a two dimensional image of a thin "slice" of the body and is therefore considered a tomographic imaging technique. Modern MRI instruments are capable of producing images in the form of 3D blocks, which may be considered a generalisation of the single-slice, tomographic, concept. Unlike CT, MRI does not involve the use of ionizing radiation and is therefore not associated with the same health hazards. For example, because MRI has only been in use since the early 1980s, there are no known long-term effects of exposure to strong static fields (this is the subject of some debate; see 'Safety' in MRI) and therefore there is no limit to the number of scans to which an individual can be subjected, in contrast with X-ray and CT. However, there are well-identified health risks associated with tissue heating from exposure to the RF field and the presence of implanted devices in the body, such as pace makers. These risks are strictly controlled as part of the design of the instrument and the scanning protocols used.

Because CT and MRI are sensitive to different tissue properties, the appearance of the images obtained with the two techniques differ markedly. In CT, X-rays must be blocked by some form of dense tissue to create an image, so the image quality when looking at soft tissues will be poor. In MRI, while any nucleus with a net nuclear spin can be used, the proton of the hydrogen atom remains the most widely used, especially in the clinical setting, because it is so ubiquitous and returns a large signal. This nucleus, present in water molecules, allows the excellent soft-tissue contrast achievable with MRI.

3.7 Microscope image processing

Microscope image processing is a broad term that covers the use of digital image processing techniques to process, analyze and present images obtained from a microscope. Such processing is now commonplace in a number of diverse fields such as medicine, biological research, cancer research, drug testing, metallurgy, etc. A number of manufacturers of microscopes now specifically design in features that allow the microscopes to interface to an image processing system.



Figure 4. A shape (in black) and its morphological dilation (in grey) and erosion (in white) by a diamond-shape structuring element.

3.8 Morphological image processing

Mathematical morphology (MM) is a theory and technique for the analysis and processing of geometrical structures, based on set theory, lattice theory, topology, and random functions. MM is most commonly applied to digital images, but it can be employed as well on graphs, surface meshes, solids, and many other spatial structures. [10]

Topological and geometrical continuous-space concepts such as size, shape, convexity, connectivity, and geodesic distance, can be characterized by MM on both continuous and discrete spaces. MM is also the foundation of morphological image processing, which consists of a set of operators that transform images according to the above characterizations.

MM was originally developed for binary images, and was later extended to grayscale functions and images. The subsequent generalization to complete lattices is widely accepted today as MM's theoretical foundation.

3.9 Remote sensing

Remote sensing is the small or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that are wireless, or not in physical or intimate contact with the object (such as by way of aircraft, spacecraft, satellite, buoy, or ship). In practice, remote sensing is the stand-off collection through the use of a variety of devices for gathering information on a given object or area. Thus, Earth observation or weather satellite collection platforms, ocean and atmospheric observing weather buoy platforms, the monitoring of a parolee via an ultrasound identification system, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), X-radiation (X-RAY) and space probes are all examples of remote sensing. In modern usage, the term generally refers to the use of imaging sensor technologies including: instruments found in aircraft and spacecraft as well as those used in electrophysiology, and is distinct from other imaging-related fields such as medical imaging. [11]

There are two kinds of remote sensing. Passive sensors detect natural radiation that is emitted or reflected by the object or surrounding area being observed. Reflected sunlight is the most common source of radiation measured by passive sensors. Examples of passive remote sensors include film photography, Infrared, charge-coupled devices, and radiometers. Active collection, on the other hand, emits energy in order to scan objects and areas whereupon a sensor then detects and measures the radiation that is reflected or backscattered from the target. RADAR is an example of active remote sensing where the time delay between emission and return is measured, establishing the location, height, speed and direction of an object.

Remote sensing makes it possible to collect data on dangerous or inaccessible areas. Remote sensing applications include monitoring deforestation in areas such as the Amazon Basin, the effects of climate change on glaciers and Arctic and Antarctic regions, and depth sounding of coastal and ocean depths. Military collection during the cold war made use of stand-off collection of data about dangerous border areas.

Remote sensing also replaces costly and slow data collection on the ground, ensuring in the process that areas or objects are not disturbed.

Orbital platforms collect and transmit data from different parts of the electromagnetic spectrum, which in conjunction with larger scale aerial or ground-based sensing and analysis, provides researchers with enough information to monitor trends such as El Niño and other natural long and short term phenomena. Other uses include different areas of the earth sciences such as natural resource management, agricultural fields such as land usage and conservation, and national security and overhead, ground-based and stand-off collection on border areas. [12]

4. Digital Video

In electrical engineering and computer science, video processing is a particular case of signal processing, where the input and output signals are video files or video streams. Video processing techniques are used in television sets, VCRs, DVDs, video codecs, video players and other devices. For example—commonly only design and video processing is different in TV sets of different manufactures. [13]

In terms of video codecs video filters are divided into three parts:

- Prefilters: used before encoding
- Intrafilters: inside of codec
- Postfilters: used after decoding

Common prefilters are following:

- Video denoising,
- Size conversion (commonly downsampling)
- Contrast enhancement
- Deinterlacing
- Deflicking, etc.

As intrafilter in current standards only deblocking is used.

Common postfilters are following:

- Deinterlacing (to convert interlaced video to progressively scanned)
- Deblocking
- Deringing

5. Related Technologies

5.1 Edge Detection in Image Space Based-on Graphics Hardware Programming

Modern programmable graphics hardware was primarily designed for 3D object rendering pipeline, it is not intended to solve image-processing problem with its hardware architectures. One way to realize image processing is to copy the contents in a pixel-buffer into main memory, and to process it in normal way supported by CPU. The post-processing result would be converted to an OpenGL texture object and transferred it back into texture memory for further use. This will lead the performance problem. In this paper, we choose to do image processing with graphics hardware instructions. Since the graphics pipeline provides 4-way vector parallel streaming-oriented processing techniques, it will be more efficient in image processing. Considering the fact that Z-depth buffer image is gray-scale and its abrupt changes primarily caused by silhouette profiles, which often have strong connectivity features. We adopt Kirsh operator to detect discontinuity edges in Z-depth buffer. On the other hand, the normal buffer contains RGB that represents the fragment normal vector; we can use dot product value of neighbor texels to inspect the abrupt changes of normal. [14]

5.2 Triangulation Shape Interpolation

At morph time t , each triangle in the intermediate shape is generated by interpolating the corresponding triangle pair between the source and target shapes using the stick interpolation. All of these interpolated intermediate triangles are then assembled together to form the intermediate triangulation. However, these intermediate triangles cannot be assembled together tightly because each triangle was interpolated individually such that the corresponding edges of two neighboring interpolated triangles may have different lengths and angles. Another is, they used an optimization method that minimizes the overall local deformation to deal with this problem. Though such approach is very reasonable and precise, it requires much computation cost. In this section we introduce an approach that can perform triangulation shape interpolation very fast. [15]

5.2.1 Assembly Order Decision. All of the intermediate triangles are assembled together one by one according to a predetermined order to generate the intermediate triangle shape. A planar graph [19] is built first from the triangulation according to its position. One triangle is chosen as the root triangle. The root triangle is the foremost in the assembly order. The remainder assembly order is obtained by traversing the planar graph from the root in breadth-first order.

5.3 Thinning and Smoothing the 3D Feature Lines

We will thin out each strip by considering each of the edges that it contains as a candidate for the final feature edge, and eliminating candidates until a topologically valid edge has been created.[16]

For each strip, we now consider all the edges which contribute to a single triangle, and classify this triangle into one of three cases, taking appropriate action in each case:

Case 1: If all the edges of the triangle contribute to that triangle only, then we look at the valency of the triangle's vertices. Any edges which terminate in a vertex of valency two are removed from the candidate set. Thus, edges e_1 and e_3 will be eliminated. If there are no vertices with a valency as low as 2, then one edge is chosen at random and removed from the set of candidates.

Case 2: If only two edges of the triangle are candidates for elimination, because the third edge contributes to another triangle, then we select one of the two edges which are available, at random, and eliminate it from the set of candidates. Sometimes two triangles of this case meet. Removing one of the candidate edge from one triangle will, of course, change the other triangle to Case 1.

Case 3: If there is only one candidate edge in a triangle, it can be straightforwardly eliminated from the candidate set.

Note that, in all cases, at least one edge is eliminated from the set of candidates. This process is repeated until no complete triangles are left in the edge 'strips'. However, there will usually be many hanging edges remaining, and possibly branches consisting of several feature edges linked end to end. These can all be eliminated by simple topological considerations. Now we have feature lines that are topologically correct, but jagged. We use a visibility graph method to smooth them. Again, we consider every segment of the jagged feature edge as a candidate for the smoothed edge, but in this case we will amalgamate edges instead of eliminating them. Suppose that p is a vertex shared by two candidate segments of the feature edge, labelled pp_1 and pp_2 . We construct two spheres with pp_1 and pp_2 as diameters. If these two spheres intersect, we will remove both pp_1 , pp_2 and the vertex p , and insert a new edge p_1p_2 , into the feature line. Otherwise, both edges will remain preserved in the set of candidates.

6. Conclusion

Image Processing is the act of examining images for the purpose of identifying objects and judging their significance" Image analyst study the remotely sensed data and attempt through logical process in detecting, identifying, classifying, measuring and evaluating the significance of physical and cultural objects, their patterns and spatial relationship. Video processing is a particular case of signal processing, where the input and output signals are video files or video streams. Video processing techniques are used in television sets, VCRs, DVDs, video players and other devices. Image and Video Processing is very helpful in many ways. In this paper, We discuss the elements of Digital Image Processing. We will also discuss the elements of Digital Video Processing. And lastly, we also review the current technologies and techniques in the fields.

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