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A SURVAY OF DIGITAL IMAGE PROCESSING AND ITS PROBLEM

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Abstract- This paper describes the basic technological aspects of Digital Image Processing with special reference to satellite image processing. Basically, all satellite image-processing operations can be grouped into three categories: Image Rectification and Restoration, Enhancement and Information Extraction.The former deals with initial processing of raw image data to correct for geometric distortion, to calibrate the data radio metrically and to eliminate noise present in the data. The enhancement procedures are applied to image data in order to effectively display the data for subsequent visual interpretation. It involves techniques for increasing the visual distinction between features in a scene. The objective of the information extraction operations is to replace visual analysis of the image data with quantitative techniques for automating the identification of features in a scene. This involves the analysis of multispectral image data and the application of statistically based decision rules for determining the land cover identity of each pixel in an image. In this review paper an analysis of their problems as well as their computation will be presented.

Index Terms: Digital image processing (DIP), signal to error ratio (SER), multilayer perceptron (MLP), phase lock loops (PLL), decision feedback adaptive equalizer (DFE), Resonance Imaging (MRI).

I. Introduction

Image processing is a rapidly growing area of computer science. Its growth has been fueled by technological advances in digital imaging, computer processors and mass storage devices. Fields which traditionally used analog imaging are now switching to digital systems, for their exibility and affordability. Important examples are medicine, _lm and video production, photography, remote sensing, and security monitoring. These and other sources produce huge volumes of digital image data every day, more than could ever be examined manually. Digital image processing is concerned primarily with extracting useful information from images. Ideally, this is done by computers, with little or no human intervention. Image processing algorithms may be placed at three levels. At the lowest level are those techniques which deal directly with the raw, possibly noisy pixel values, with denoising and edge detection being good examples. In the middle are algorithms which utilise low level results for further means, such as segmentation and edge linking. At the highest level are those methods which attempt to extract semantic meaning from the information provided by the lower levels, for example, handwriting recognition. The literature abounds with algorithms for achieving various image processing tasks. However, there does not appear to be any unifying principle guiding many of them. Some are one dimensional signal processing techniques which have been extended to two dimensions. Others apply methods from alternative disciplines to image data in a somewhat inappropriate manner. Many are the same basic algorithm with parameter values tweaked to suit the problem at hand. Alternatively, the parameters are optimized with respect to a suitable training Image processing is a rapidly growing area of computer science. Its growth has been fueled by technological advances in digital imaging, computer processors and mass storage devices.

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In the present context, the analysis of pictures that employ an overhead perspective, including the radiation not visible to human eye are considered. Linear processing techniques are very important tools that are used extensively in digital signal image processing. Their mathematical simplicity and the existence of a unifying linear systems theory make their design and implementation easy. Moreover, linear processing techniques offer satisfactory performance for a variety of applications.

However, many digital image processing problems cannot be efficiently solved by using linear techniques. An example where linear digital image processing techniques fail is the case of non-Gaussian and or signal dependent noise filtering (e.g. impulsive noise filtering).

Such types of noise appear in a multitude of digital image processing applications. Impulsive noise is frequently encountered in digital image transmission as a consequence of man-made noise sources or decoding errors. Signal- dependent noise is the photoelectron noise of photo sensing devices and the film-grain noise of photographic films [l]. Speckle noise that appears in ultrasonic imaging and in laser imaging is multiplicative noise; i.e. it is signal-dependent noise. Another example where linear techniques fail is the case of nonlinear image degradations. Such degradations occur during image formation and during image transmission through nonlinear channels [4], [5]. The human visual perception mechanism has been shown to have nonlinear characteristics as well [1], [2].

Linear filters, which were originally used in image filtering applications, cannot cope with the nonlinearities of the image formation model and cannot take into account the nonlinearities of human vision. Furthermore, human vision is very sensitive to high-frequency information. Image edges and image details (e.g. corners and lines) have high-frequency content and carry very important information for visual perception. Filters having good edge and image detail preservation properties are highly suitable for digital image filtering. Most of the classical linear digital image filters have low-pass characteristics [17]. They tend to blur edges and to destroy lines, edges, and other fine image details. These reasons have led researchers to the use of nonlinear filtering techniques. Nonlinear techniques emerged very early in digital image processing. However, the bulk of related research has been presented in the past decade. This research area has had a dynamic development. This is indicated by the amount of research presently published and the popularity and widespread use of nonlinear digital processing in a variety of applications. Most of the currently available image processing software packages include nonlinear techniques (e.g. median filters and morphological filters). A multiplicity of nonlinear digital image processing techniques have appeared in the literature. The following classes of nonlinear digital image signal processing techniques can be identified at present:

1) order statistic filters
2)homomorphic filters,
3) polynomial filters,
4) mathematical morphology,
5) neural networks, and
6) nonlinear image restoration.

One of the main limitations of nonlinear techniques at present is the lack of a unifying theory that can encompass all existing nonlinear filter classes. Each class of nonlinear processing techniques possesses its own mathematical tools that can provide reasonably good analysis of its performance. Cross-fertilization of these classes has been shown to be promising. For example, mathematical morphology and order statistic filters have as well, most of the reported work has been applied to digital image processing. We shall focus our presentation on digital image processing applications, in order to render it more concise.

In the following, we shall focus on the description of the order statistics techniques. Although such techniques have been applied to digital signal processing.

Since its first use, several modifications and extensions of the median filter have been proposed. Many of them have solid theoretical foundations from the theory of robust statistics [3],[5]. However, there are also filters based on order statistics that have ad hoc structures, due to the lack of a powerful unifying theory in the area of nonlinear filtering. Several efforts have been made in the past decade to provide a unifying theory in the area of order statistics filtering. Some fruitful results based on threshold decomposition (to be described later) are expected to provide useful design and implementation tools. In general, filters based on order statistics have good behavior in the presence of additive white noise or impulsive noise, if they are designed properly. Many of them have good edge preservation properties. The adaptation of order statistics filters is a very important task. It is well known that image characteristics (e.g. local statistics) change from one image region to the other. Noise characteristics usually vary with time. Thus, digital image filters based on order statistics must be spatially and/or temporally adaptive. Furthermore, the characteristics of the human visual system (e.g. edge preservation requirements, local contrast enhancement) lead to spatially adaptive digital image filter structures as well. Another reason for the adaptation of the order statistics filters has to do with the difficulties encountered in the optimal design of such filters for certain characteristics of signal and noise. Although order statistics filters are based on rich mathematical foundations, such design algorithms do not exist or are difficult to implement. One of the main reasons for the popularity and wide spread use of certain filters based on order statistics is their computational simplicity. Their computation can become faster if appropriate fast algorithms are designed. Several such algorithms have appeared in the literature, especially for the fast (serial or parallel) implementation of the median filter. Another research activity is the design of special VLSI chips for order statistics filtering. A number of chips for fast median and max/min filtering have been presented in the literature. The related efforts for fast filter implementation are reviewed in this paper as well[12].

II. PROBLEMS IN DIP

Now in this paper we discuss about the problems in DIP.

A. Edge Detection

Edge detection, a region- splitting approach, produces an edge map that contains important information about the image. The memory space required for storage is relatively small , and the original image can be restored easily from its edge map. Many methods have been proposed for edge detection in digital images proposed a method for edge based image segmentation using Object Localization and Border Detection Criteria proposed a method for edge detection using Adaptive Neuro-Fuzzy System.

The system consists of a MultiLayer Perceptron (MLP)-like network that performs image segmentation by adaptive thresholding of the input image proposed a method for edge detection using Fast Multilevel Fuzzy Edge Detection proposed a method for edge detection using wavelets for SEM images.This method facilitates nanoscale edge detection and characterization by providing a systematic threshold determination step. SAR Image Despeckling Using Edge Detection and Feature Clustering in Bandelet Domain proposed. proposed a method for edge enhancement using Wavelet Transform for Automatic Edge Detection in SAR Images. This method uses a novel technique for automatic edge enhancement and detection in synthetic aperture radar (SAR) images proposed a method for Retinal Image Analysis Using Curvelet Transform and Multistructure Elements Morphology by Reconstruction.

Beamlets and multiscale image analysis proposed proposed a method for an efficient FPGA implementation of MRl image filtering and tumour characterization using Xilinx System Generator [10] proposed a method for Architecture for filtering images using Xilinx System Generator proposed a method for Implementation and Evaluation of Image Processing Aigorithms on Reconfigurable Architecture using C-based Hardware Descriptive Languages. Beamlet transform and multiscale linear feature extraction proposed . An overview of MRl Brain classification using FPGA implementation proposed. FPGA implementation of image compression using bottom-up approach of Quad tree technique proposed by [7],[8].

B. Signal To Error Ratio (SER)

Extracted logo image andreceived image after both watermarking process are analysed in terms of signal to error ratio. Effect of various scaling factors can be seen on the values of signal to error ratio (SER) for both received output image and extracted logo image. '.bmp' image to generate watermark embedded image by inserting a logo '.bmp' image with non zero scaling factor.

Types of noise: The previous example illustrated the manner in which an image may be affected by noise during the acquisition process. The properties of the noise introduced at each capture step are likely to vary. However, there are three standard noise models which model well the types of noise encountered in most images: additive, multiplicative, and impulse noise.

C. Additive Noise

The Let f'(x,y)be the noisy digitized version of the ideal image f(x,y)and n(x,y,)/be a .noise function. which returns random values coming from an arbitrary distribution. Then *additive noise* can be described by

$$f'(x,y) = f(x,y) + n(x,y)$$

Additive noise is independent of the pixel values in the original image. Typically n(x,y)is symmetric about zero. This has the effect of not altering the average brightness of the image, or large parts thereof. Additive noise is a good model for the thermal noise within photo-electronic sensors.

D. Multiplicative noise

Multiplicative noise, or speckle noise, is a signal dependent form of noise whose magnitude is related to the value of the original pixel [9]. It describes one simple form it can take, but a more complex function of the original pixel value is also possible. Multiplicative noise is an approximation to the noise encountered in images recorded on [10] and from synthetic aperture radar.

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E. Impulse Noise

Impulse noise has the property of either leaving a pixel unmodified with probability 1-p or replacing it altogether with probability ‘p”.Restricting n(x,y) /to producing only the extreme intensities 0 or z-1 results in salt-pepper noise. The source of impulse noise is usually the result of an error,

$$f'(x,y) = \begin{cases} n(x,y) & \text{with probability} \quad p \\ f(x,y) & \text{with probability} \quad 1-p \end{cases}$$

in transmission or an atmospheric or man-made disturbance[15].

F. Quantization Noise

Quantization noise is due to the quantization of pixel values during the analog to digital conversion. For example, imagine an analog image with brightness values ranging from 0 to 10. If it is quantized to accuracy 0.1 the digitized image will have 101 distinct grey levels. A given intensity z could have originally been anywhere in the range.(z+,.05)This uncertainty in the true value of z is called quantization noise

G. The Noise Function

Usually the properties of the noise function n(x,y) do not vary with x and y. A spatially invariant stochastic process is referred to as being *stationary*. The noise function could theoretically take any form, but many standard probability distributions have been found useful. For additive noise, the Gaussian and Laplacian distributions. The standard case of impulse noise uses a uniform distribution on (0, z-1). The most common noise model used in this thesis is an additive zero-mean Gaussian of unknown variance, independently and identically distributed for each pixel. The application to alternative noise models is also considered. Some algorithms developed for additive noise can be adapted to multiplicative noise by logarithmically transforming f(x,y) applying the algorithm, and then applying the inverse transform.

A. Aliasing

As just demonstrated, the sample values obtained from a sinusoid which has been sampled fewer than two times per period will be identical to those obtained from a sinusoid with a longer period. This ambiguity about which original function produced the set of samples is called aliasing in sampling, but similar effects show up whenever periodic functions are multiplied or added. In other disciplines, these go by different names such as beats, Moiré fringes, and heterodyning. To illustrate, consider the product of two sinusoidal functions with the different periods X1and X2(and thus spatial frequencies (ξ1 = 1 X1 , ξ2 = 1 X2), which may be written as the sum of two sinusoids with different spatial frequencies: cos [2πξ1x] · cos [2πξ2x] =1/2cos [2π(ξ1 + ξ2)x] + 1/2cos [2π(ξ1 − ξ2)x] (note that the converse is also true; the sum of two sinusoids with the same amplitude and different frequencies may be written as the product of two sinusoids). The second term in the expression for the product oscillates slowly and is the analog of the aliased signal.

B. Doppler Shift And Frequency Domain Spreading

Motion of transmitter, receiver, channel boundary and media introduce in Doppler shift and frequency domain spreading. It is defined as a delay-Doppler double spreading channel [1]. Its characteristics change with time and location, its bandwidth is very limited, and there are many noise sources and interferences. Only with an effective integration of several signal procession methods can low BER (Bit Error Rate) be achieved.

Signal processing for high speed underwater acoustic image transmission includes two main parts, one is underwater coherent communication signal processing, another one is the robust image compression algorithm. To transmit data in underwater acoustic channel at high speed, coherent communication is the first choice because of its high bandwidth efficiency. In this paper only MPSK (M-ary Phase Shift Keying) modulation is discussed.

One main technical point of coherent communication is adaptive equalization. In 1990s, developed a new coherent communication receiver consists of multi-channel decision feedback adaptive equalizer (DFE), adaptive combiner and 2^{nd} order digital phase lock loops (PLL) [6].

III. 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.

A. 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 multidimensional data from a medical scanner [22].

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).

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

B. 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.

C. 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. [23],[24].

D. 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. [24],[25].

E. 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 standoff 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. [24].

IV. CONCLUSION

The image processing require large amount of processing power. In the distributed environment where network latency significantly affects the power of execution the particular operations. There is need some security algorithms in distributed image processing in client server architecture. In the proposed work jpeg encoder and jpeg decoder will added for high performance with security in this architecture.

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