The Summary of Digital Image Processing

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1. The original of digital image processing

The image is the light information transmitted or reflected by an object, which is formed in the person's brain through the reception of the person's visual system. The majority information we get from the world is visual information. For the convenience and timely reception of images from all over the world, and ensure the sharpness of the image and considering image transmission, storage mode, capacity and other causes of image distortion, the image must be processed accordingly. Digital Image processing plays an important role in many fields, and we cannot live better without digital image processing in the future.

One of the first applications of digital images was in the newspaper industry, when pictures were first sent by submarine cable between London and New York. Introduction of the Bartlane cable picture transmission system in the early 1920s reduced the time required to transport picture across the Atlantic from more than a week to less than three hours. The first computer powerful enough to carry out meaningful image processing tasks appeared in the early 1960s. The birth of what we call digital image processing today can be traced to the availability of those machines and to the onset of the space program during that period. In parallel with space applications, digital image processing techniques began in the late 1960s and early 1970s to be used in medical imaging, remote Earth resources

observations, and astronomy. The invention in the early 1970s of computerized axial tomography (CAT),also called computerized tomography(CT) for short, is one of the most important events in the application of image processing in medical diagnosis.

From the 1960s until the present, the field of image processing has grown vigorously. In addition to applications in medicine and the space program, digital image processing techniques now are used in a broad range of applications. Computer procedures are used to enhance the contrast or code the intensity levels into color for easier interpretation of X-rays and other images used in industry, medicine and the biological sciences. Geographers use the same or similar techniques to study pollution patterns from aerial and satellite imagery. Image enhancement and restoration procedures are used to process degraded images of unrecoverable objects or experimental results too expensive to duplicate. In archeology, image processing methods have successfully restored blurred pictures that were the only available records of rare artifacts lost or damages after being photographed. In physics and related fields, computer technologies routinely enhance images of experiments in areas such as high-energy plasmas and electron microscopy. Similarly successful applications of image processing concepts can be found in astronomy, biology, nuclear medicine, law enforcement, defense and industry.

2. The technologies in digital image processing

Image transformation: Usually the image array is large, so the processing in the spatial domain involves a large amount of computation. Therefore, we can use a variety of image transformation methods, such as Fourier transform, Walsh transform, discrete cosine transform and other indirect processing technology, converting the spatial domain processing into transform domain processing, which can reduce the amount of calculation, and can be more effective (Fourier transform can be digital filtering in the frequency domain). At present, the wavelet transform of the emerging research has good localization in the time domain and frequency domain, and it has a wide and effective application in image processing.

Image Compression Coding: Image coding compression reduces the amount of data describing the image (e.g. the number of bits) in order to easy to transfer, reduce processing time and the amount of memory used. Compression can be obtained without distortion, or under permissible distortion conditions. Coding is the most important method of compression technology, it is in the image processing technology is the development of the earliest and more mature technology.

Image Enhancement and Restoration: The purpose of image enhancement and restoration is to improve the quality of the image, such as removing noise, improving image clarity, and so on. Image enhancement does not take into account the reasons for image degradation, highlighting the part of interest in the image. Such as strengthening the high-frequency

components of the image, the image can make the outline of the object clear, the details are obvious; such as strengthening the low-frequency components can reduce the impact of noise in the image. Image restoration requires a certain understanding of the reasons for image degradation, generally speaking, should be based on the degradation process to establish a "degradation model", and then use a filtering method to restore or rebuild the original image.

Image Segmentation: Image segmentation is one of the key technologies in digital image processing. Image segmentation is the extraction of meaningful parts of the image, the meaningful features are the edges of the image, the area, etc., which is the basis for further image recognition, analysis and understanding. Although a number of edge extraction and regional segmentation methods have been developed, there is no effective method for universal application to various images. Therefore, the research on image segmentation is one of the hotspots in image processing.

Image Identification: image identification (classification) belongs to the category of pattern recognition. The main content is that the image is segmented and extracted by some preprocessing (enhancement, restoration, compression). Image classification often adopts classical pattern recognition method, statistical pattern classification and syntactic (structure) pattern classification. In recent years, newly developed fuzzy

pattern recognition and artificial neural network model classification have been paid more and more attention in image recognition. 3. The applications of digital image processing in medical field.

In the following paragraph a number of recent developments in medical imaging are outlined, with the focus being on the application of image processing techniques. Medical images are at the core of medical science and an enormous source of information that need to be utilized. Image processing techniques with regards to biomedical images are generally either used for the retrieval of images (Content Based Image Retrieval) or for analysis and modification of images.

In the development of biomedical imaging systems, the idea of image retrieval goes hand in hand with the need for digital image processing. There are three primary application areas: firstly, image restoration, secondly, the processing of data for autonomous machines perception and finally the processing of images for improvement in human perception for example comparison or feature extraction. The field of image processing has seen much research and advance since 1964, when the pictures of the moon transmitted by Ranger 7 were processed by a computer to correct various types of image distortions (Gonzales and Woods, 1993). The application of the image processing techniques has seen its place in often unrelated problems, since they require the same underlying technology. In medicine, image processing techniques have

been used for assisting in diagnosis and research. Various techniques for image improvement like image enhancement and image restoration are used. Image analysis techniques including morphological image processing, edge detection, image feature extraction, image segmentation, shape analysis find much use in the medical field. More specifically, much research is being done to change the 2-dimensional images to provide a 3-Dimensional image structure, automated detection of certain specific features， which largely depends on what kind of images are being processed, and automated comparison of images to show the differences among them. Visualization of three-dimensional medical images is usually the use of human visual characteristics, through the computer on the two-dimensional digital tomographic image sequence of three-dimensional body data processing, to transform it into an image with intuitive three-dimensional effect to show the three-dimensional morphology of human tissue. Image visualization techniques are usually divided into two methods: surface rendering and volume rendering.

Picture archiving and communication system(PACS) is a new system at home and abroad in recent years. The medical image information technology, is designed for medical image management and design. Including the image acquisition, processing, storage, display or print hardware and software systems, is the medical shadow , digital image technology, computer technology and network communications

technology combined production. PACS needs to solve the problem of data transmission and image storage, how to use limited storage space to store more images, medical image compression is one of the key technologies, which image processing technology in a focus on the problem in recent years.

Medical image fusion is the process of registering and combining multiple images from single or multiple imaging modalities to improve the imaging quality and reduce randomness and redundancy in order to increase the clinical applicability of medical images for diagnosis and assessment of medical problems. Multi-modal medical image fusion algorithms and devices have shown notable achievements in improving clinical accuracy of decisions based on medical images.

In recent years, with the development of artificial intelligence and automatic driving the development and application of digital image processing is also more extensive, automatic driving is the development trend of the automobile industry, the autopilot cannot do without image recognition, with the gradual development of deep learning and artificial neural network, image recognition combined with the new application areas, such as face recognition iris recognition, etc..

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