Development and Research of the Key Technologies of Digital Image Processing

Zihua Wang [1], Jing Yang [2] and Linlin Yang [1]

[1.]Nanchang Institute of Science & Technology
[2.]Jiangxi Vocational Technical College of Industry Trade

Keywords: Digital image processing; Key processing technologies; Development

Abstract: With the continuous development and progress of computer technology, the digital image technology has the advantages of image processing diversity, high accuracy, good image reproduction and large processing capacity. This paper discusses the development and prospect of image processing system by analyzing the current situation of image processing technology and solving the key technologies of digital image processing means.

Introduction

According to different application occasions, the image processing system can be divided into the special processing system and the general processing system. The special system is designed for a special field, such as military image processing, remote sensing image processing, medical image processing, robot vision, security and detection (fingerprint, face, license plate recognition), etc. The general image processing is designed to meet the needs of ordinary customers and realize the production and processing of digital images. The digital image processing refers to the application of a series of operations and transformations to the input digital image to achieve the desired results. The early image processing aims at improving the subjective visual quality of images, and the typical applications include image denoising, image enhancement, image restoration, super-resolution reconstruction, etc. The current image processing technology can also facilitate the computer processing or recognition by extracting features or special information of images. The typical applications include image segmentation, image retrieval, image registration, image fusion, etc.

Research Status of Digital Image Processing Technology

The image processing system is an application system to satisfy the users' needs with help of the image processing technology. According to the processing flow of image data, the image processing system can be expressed as the flow chart in Figure 1. Firstly, the image information is acquired from the imaging equipment; secondly, the image information is preprocessed to improve the image quality; thirdly, the image is segmented to obtain the target area; fourthly, the image target area is analyzed to extract the target features; finally, the image is recognized and understood according to the domain knowledge, and the results are displayed.

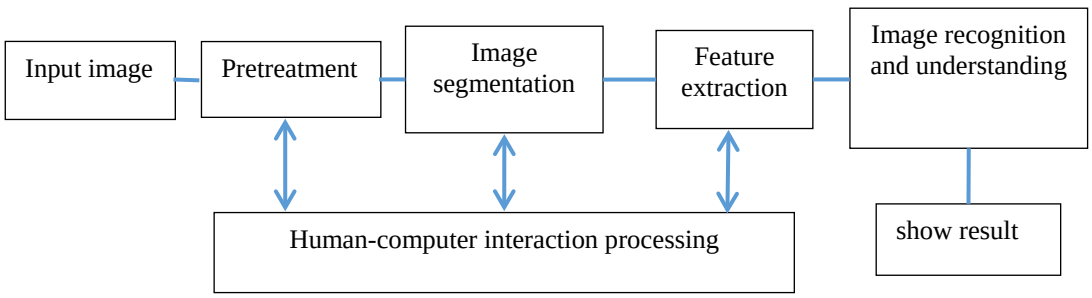

Figure. 1 Flow Chart of Image Processing System

  DOI: 10.25236/icess.2019.379

Special image processing system.

The special image processing system mainly refers to the processing system designed to meet the special requirements. Generally, it is closely combined with professional knowledge to obtain the sufficient prior knowledge to build a knowledge base. It's image processing process generally includes the following steps: obtaining the original continuous signal from the image acquisition equipment, quantifying the signal, realizing image enhancement to obtain a digital image with better quality, extracting the image features, carrying out the image pattern recognition with help of the system knowledge base and obtaining the processing results. Most of these systems realize the image processing function based on the combination of the hardware equipment and the software appliances, such as the radar search system and the medical imaging system.

General image processing system.

The general image processing system is designed to meet the needs of ordinary customers. Such systems are often used to process the quantified images on the basis of the knowledge of digital image processing to improve the image display effect or produce the new images.

Common image browsing and editing systems.

The image browsing system mainly refers to the image browsing tools to realize the image browsing function, such as ACD See, Hero Photo Show, etc. Its functions are reflected in the number of image file formats that can be browsed and the speed and quality of image display. Among these systems, ACDsee has been widely used and gain the users' trust because of its simple interface, convenient operation and powerful functions. The image software with the single browsing function has gradually failed to meet the needs of users, and it will be the development trend of such software to combine with the internet. The image production system mainly refers to the image reprocessing systems based on the image processing methods, such as "Photoshop" and "Ulead Photo Express".

Means of Digital Image Processing Technology

Image transformation.

The amount of computation for image array will be very large when processing directly in the spatial domain. Therefore, various image transformation methods, such as Fourier transform, Laplace transform and other indirect processing technologies, are often used to transform the spatial domain processing into the domain processing, which can not only reduce the amount of computation, but also obtain the more effective theory.

Image enhancement and restoration.

The purpose of image enhancement and restoration is to improve the image quality. Image enhancement does not need to consider the reasons of poor image quality, but only highlights the parts of interest in the image. For example, the contour and details of the object in the image can be clearly visible by emphasizing the high-frequency component of the image. The noise in the image can be reduced by emphasizing the low-frequency component of the image. Image restoration requires a certain understanding of the causes of poor image quality. Generally speaking, a degradation model should be established according to the process of quality degradation, and then a certain filtering method should be adopted to reconstruct the original image.

Image coding and compression.

With more and more widely used of the digital image, the huge amount of data of digital image sets a great demand on the operation speed and storage capacity of a computer. so it is very necessary to compress the amount of data. Image coding and compressing can reduce the amount of data for image information in order to save the time of image information transmission and processing, and reduce the memory capacity occupied. Image compressing can be realized without image distortion, and even some compressing operations can be realized in the case of image distortion.

Image segmentation.

The image segmentation is a key technology for digital image processing. Its purpose is to segment the required and meaningful feature areas in the image, including the edges and regions of

the image. Image segmentation is also the basis of subsequent image recognition, analysis and understanding. Although many algorithms for edge extraction and region segmentation have been developed, there is not yet a general method for all kinds of images. Therefore, the research of image segmentation still needs to be deepened, and image segmentation is still the focus of current image processing research.

Image recognition.

The image classification and recognition belongs to the category of pattern recognition. Its principle is to realize the image segmentation and features extraction for the image judgement and recognition after some preprocessing operations such as transformation, enhancement, restoration and compressing. The common pattern classification methods for the image classification include the statistical pattern classification method and the syntactic structure pattern classification method. The newly developed pattern recognition methods in recent years include the fuzzy pattern recognition method and the artificial neural network pattern recognition method, and these new technologies have been paid more and more attention in the image classification.

Features and recognition.

In order to make the image recognized by people's visual system recognizable by the computer system, it is necessary to find an algorithm to analyze the features of the image, and then to express the features mathematically and teach the computer to understand these features, so that the computer has the ability to recognize the image. It is the machine learning, or the pattern recognition.

The Development Trend of Digital Image Processing Technology

Image enhancement and image restoration.

The image enhancement is to enhance the interesting object or feature in the image according to the need of image processing. Generally, the image enhancement does not consider the causes of image quality degradation, and other features of the image may be attenuated or eliminated in the process of transformation. The image restoration is used to restore the image degradation in the process of discretization and transmission through the certain transformation operations. The process of image restoration is complex. Its main steps include analyzing the causes of image degradation, establishing the image degradation model and eliminating the image degradation.

Image recognition and understanding.

The image recognition and understanding is the process of in-depth analyzing and processing of the image information, obtaining the information and features of each object in the image and carrying out the subsequent processing. In other words, it is the process of reproducing the recognition and understanding of image with help of the information processing technology. Image recognition and understanding is the basis of the deep image processing, and is the focus of current image processing technology research.

Image reconstruction technology.

The image reconstruction technology is the process of restoring the original object's structure shape according to the image data consisting of the object's structure information obtained under a certain detection mode. It can be divided into two-dimensional reconstruction and three-dimensional reconstruction. The image reconstruction technology has been widely used in many fields, especially in medical image, address exploration and detection, etc. The information of the object interior can be obtained by means of ray, based on which, the interior structure of the object can be reconstructed.

Virtual reality technology.

The virtual reality technology is used to reproduce the real three-dimensional scene and simulate the unknown environment and model by means of computer technology, control technology and other technologies, and which has a strong interaction. Now, the virtual reality technology has been widely used in manufacturing technology, commodity display, planning and design, environmental simulation, film and television entertainment and network multimedia and other fields.

Image coding technology.

Due to the large amount of data and redundant information, the digital image coding technology is of great significance in image transmission and storage. Coding and compressing can greatly reduce the redundant information of the image, improve the speed of image transmission and reduce the storage space. According to the damage degree of image information, the image compression can be divided into lossless compression and lossy compression. At present, the lossy compression has been the current research focus instead of the lossless compression due to its compression ratio with a certain limitation.

Conclusion

With the rapid popularization of computer and digital products and the development of image processing technology, the image processing system has become an indispensable part of our life, work and scientific research. The image processing system includes image segmentation, image recognition, image synthesis and so on. The image processing is a technology closely related to people's lives, and it is also a frontier subject with broad prospects. At present, many problems about image processing have not been completely solved, and the new theories and ideas are likely to emerge at any time. The image processing system should constantly apply the new technologies to meet the needs of users, and make the image processing become part of our daily lives.

References

[1] Zhang Y D, Zhu S M, Li L. Development of Digital Image Processing System Based on MATLAB[J]. Advanced Materials Research, 2014, 971-973:1594-1597.

[2] Min S, Kong H J, Yoon C, et al. Development and evaluation of an automatic acne lesion detection program using digital image processing[J]. Skin Research & Technology, 2013, 19(1):e423-e432.

[3] Sun Y L. Research on the Application and Development of Digital Image Processing Technology[J]. Computer Knowledge & Technology, 2014, 43(1):183–186.

[4] [4]Ying H, Chen G, Chen L, et al. Research on Evaluating Method for Print Mottle Based on Digital Image Processing[M]// Advanced Graphic Communications, Packaging Technology and Materials. 2016.

[5] Dutta S, Pal S K, Mukhopadhyay S, et al. Application of digital image processing in tool condition monitoring: A review[J]. Cirp Journal of Manufacturing Science & Technology, 2013, 6(3):212-232.

[6] Patil J, L. Chaudhari A. Development of Digital Image Processing using Fuzzy Gaussian Filter Tool for Diagnosis of Eye Infection[J]. International Journal of Computer Applications, 2013, 51(19):10-12.

[7] Liu C. Research of Motion Blur Image in Digital Image Recovery Technology[J]. Lecture Notes in Electrical Engineering, 2014, 270:737-742.

[8] [8]Huang J T, Peng J, Li F B. Based on Digital Image Processing Ore Appraisal Method Research[J]. Applied Mechanics & Materials, 2013, 385-386(1):5.

[9] [9]Wang L, Yao H W, Wu Z X, et al. Research on Evolution of Electrical Fire Melted Marks Based on Digital Image Processing Technology[C]// International Conference on Intelligent Systems Design & Engineering Applications. 2014.

[10] Torres E, Luna P, Takeuchi C. Determination of the Delamination Percentage of Compacted Bamboo Guadua Using Extended Field Digital Images Processing[J]. Key Engineering Materials, 2014, 600:15-20.

[11] Ye Q, Hu Y, Sun Y. Research the Length of the Positive Corona Glow Using the Digital Image Processing Technology[C]// Electrical Insulation & Dielectric Phenomena. 2014.

[12] Hubbe J M, Whiteman C D, Foote H P, et al. Applications of digital image processing to ongoing research in complex terrain meteorology[M]// Applications Of Digital Image Processing To Ongoing Research In Complex Terrain Meteorology. 2016.

[13] Dutta S, Pal S K, Sen R. Digital Image Processing in Machining[M]// Modern Mechanical Engineering, Materials Forming, Machining and Tribology. 2014.

[14] Tyukin A L, Priorov A L, Lebedev I M. Research and development of an indoor navigation system based on the digital processing of video images[J]. Pattern Recognition & Image Analysis, 2016, 26(1):221-230.

[15] Wang C J, Xin B X. Abnormal Image Monitoring for Transmission Line Based on Digital Image Processing[J]. Advanced Materials Research, 2013, 710:613-616.