# Application of Image Signal Processing in Image Sensing Technology

**Zhang Haohui**

Huaiyin Normal University School of Physics and Electronic Electrical Engineering, Huaian, China

**Keywords:** Computer Technology; Image Processing; Image Sensing

**Abstract:** With the rapid development of computer technology, the research and application of image processing technology has gradually attracted widespread attention. The research and application of image signal processing technology is of great significance in the field of security. The signal processing equipment of all digital images, such as video surveillance system, which we are familiar with at ordinary times, will be affected by external factors and result in poor image quality. People have higher and higher requirements for the quality of monitoring images. Promoting the practical value of monitoring images has become a new requirement for the whole monitoring industry. Under the current trend of intelligent and high-definition monitoring, digital image signal processing technology is the most basic application unit for intelligent and high-definition monitoring. Intellectualization and high definition have accelerated the research and development process of image sensing technology, and image signal processing technology will continue to evolve under such market demand.

## 1. Introduction

With the development of computer and network technology, video surveillance has developed to the era of all-digital surveillance based on IP network, and entered the era of the third generation of all-digital network video surveillance [1]. The application of digital image signal processing is more and more extensive. The main function of digital signal processing is to post-process the output signal of the front-end image sensor. Although these technologies have improved image signal processing to some extent. However, limited by weather factors, monitoring system equipment factors and technical conditions, the effect of image signal processing often can not reach the desired state [2]. Security forensics or identification can not achieve the expected results, and the system cannot be used normally. Digital products are limited by severe weather and the technical conditions of the monitoring system itself, and video images often fail to achieve ideal results [3]. The instability of image quality causes difficulties in identification, forensics, event analysis and other operations, making the system unable to be used normally. The research and application of image signal processing technology is of great significance in the field of security.

People have higher and higher requirements for the quality of monitoring images. Promoting the practical value of monitoring images has become a new requirement for the whole monitoring industry [4]. People have higher and higher requirements for the quality of monitoring images. Promoting the practical value of monitoring images has become a new requirement for the whole monitoring industry [5]. The application of digital image signal processing is more and more extensive. The main function of digital signal processing is to perform post-processing on the signal output by the front-end image sensor [6]. Intellectualization and high definition have accelerated the research and development process of digital image processing technology, and image signal processing technology will continue to evolve under such market demand [7]. People are demanding higher and higher quality of surveillance image, and improving the practical value of surveillance image has become a new requirement for the whole surveillance industry [8]. Intelligence and high definition have accelerated the development process of digital image processing technology, and image signal processing technology will continue to evolve under such market demand. With the increasing demand for image processing, intelligent and high-definition image signal processing technology continues to improve.

  DOI: 10.25236/mmmce.2019.079

## 2. Basic Functions of Image Signal Processing

### 2.1. Automatic Exposure Technology

When taking photos, we often encounter many situations of scene transition, which will make the image ugly and change the effect of real imaging. The indoor light source is usually sunlight, while the outdoor light source is sunlight. The intensity of sunlight is usually hundreds to thousands of times of that of fluorescent lamp. When people walk from the indoor to the outdoor, they will feel the light is very dazzling, but after a while, once they adapt to the external environment, they will feel that the outdoor objects are not much brighter than the indoor ones. The exposure time and gain need to be adjusted to achieve a new balance. Similarly, for other cases, such as from dark to bright, from bright to very bright, from very bright to bright, from bright to dark, etc., this adjustment is needed [9]. Automatic exposure technology can effectively solve the problem of excessive scenes and make precise adjustments to the exposure time and gain.

Automatic exposure control uses a specific algorithm to make statistics on the captured images, which can be used as a basis to judge whether there is a sharp change in light intensity at this time, and finally determine the exposure time and gain size and make appropriate adjustments. There are two combinations of multiple digital image windows: series and parallel. The adopted method is a control mode in which a proportion link and a plurality of digital image links are connected in parallel, and each digital image link tracks and controls a signal with a frequency. The system also takes into account the influence caused by the non-linearity of the inverter. The inverter parameters are shown in Table 1.

Table 1 Driver power inverter parameters

| Parameter | Numerical |
|---|---|
| Modulation carrier period (μs) | 150 |
| Modulated carrier frequency (kHz) | 15 |
| Delay time (μs) | 6 |
| Flywheel diode voltage drop (v) | 3 |

### 2.2. Noise Removal Technology

Noise is the main factor affecting image quality, so it has always been the focus of image signal processing technology. The working condition of the image sensor is affected by various factors, such as the environmental conditions in image acquisition and the quality of the sensor components themselves. Traditional spatial denoising methods include mean filtering and median filtering. Mean filtering can effectively smooth noise, but at the same time it will blur the edges. Noise will not only affect the integrity of the picture, but also cause the picture to be lost in serious cases, so it is necessary to denoise in order to ensure the image quality. The operation process of median filtering method is similar to that of mean filtering method. The difference is that the median value of all the pixels in the sliding window replaces the pixels in the center of the sliding window. Traditional spatial denoising methods include mean filtering and median filtering. Mean filter can effectively remove smooth noise, but it will affect the quality of the edge. Bilateral adaptive filters not only have a good ability to filter all kinds of noise, but also retain the details of the image.

## 3. Characteristic Functions of Image Signal Processing

### 3.1. 3D Digital Noise Reduction

In video image denoising algorithms, time domain denoising has more advantages than space denoising in protecting edges and details. According to this principle, a new denoising algorithm combining space domain and time domain, namely 3D digital denoising algorithm, is proposed. The function of 3D digital noise reduction is mostly used in low illumination scenes and motion scenes, but for objects with intense motion, there are often shadow phenomena. If the motion intensity is too high, the current block is filtered in spatial domain. Through the combination of time domain and

space domain, the noise in video image is effectively eliminated. If the motion intensity is too large, the current block is filtered in spatial domain, and if the motion intensity is small, the time domain filtering is used. A new 3D digital noise reduction algorithm is formed by combining spatial noise reduction with time domain noise reduction technology.

In the time domain, according to motion estimation, blocks are searched and matched simultaneously in the previous frame and the following frame of the current frame of the video, and the searched results are subjected to motion intensity detection [10]. This method of combining time domain and space domain can effectively eliminate noise in video images, thus obtaining images with clear image details and high quality. For signals, due to band limitation, signal energy is mainly distributed in the low frequency region. Therefore, for noisy signals, the proportion of noise energy is small in the low frequency region and large in the high frequency region. Therefore, the focus of denoising should be on the high frequency region. Figure 1 is a structure of a digital image analysis system.

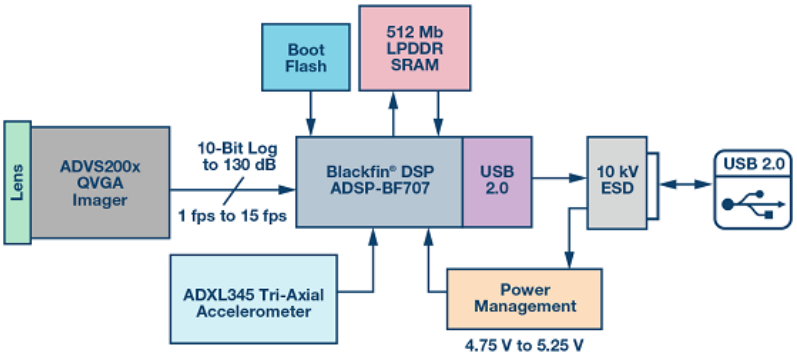


Fig.1. structure of digital image processing and analysis system

### 3.2. Wide Dynamic Algorithms

In order to let the camera see the characteristics of the impact under strong contrast, wide dynamic technology can be used. Wide dynamic technology is a technology used to let cameras see the characteristics of images under very strong contrast. Strictly speaking, there are two kinds of wide dynamic processing algorithms. One is to compress the original data of wide dynamic images to a low dynamic range. One is to improve the clarity of detail and contrast in the original low dynamic range image through algorithm. The principle of wide dynamic processing algorithm is to use short exposure mode in strong light area and long exposure mode in low light area. The long and short exposure data are synthesized according to the relevant algorithm to obtain the detailed and contrast images. In short, the principle of wide dynamic algorithm is to use long exposure in low light area and short exposure in strong light. Then the data of long exposure and short exposure are synthesized by correlation algorithm. The image obtained by wide dynamic algorithm can preserve the details of dark area, bright area and not overexplode.

## 4. Conclusions

Image signal processing technology has been applied to many industries. Although it has been applied in many aspects and achieved good results, there are still some problems in practice. At present, the research and application of image signal processing technology in monitoring industry is still in its infancy. The objective environment is complex and changeable. There are still many places to work hard to get stable and accurate results. Digital image signal processing technology is the most basic application unit of intellectualization and high definition. Its performance directly affects the quality of the entire video surveillance system. Automatic exposure algorithm and noise removal algorithm for image signal processing belong to basic functions, while wide dynamic algorithm and 3D digital noise reduction algorithm belong to characteristic functions. In order to obtain clear image quality, it is necessary to ensure that technologies and measures meet the requirements. Under the current trend of intelligent and high-definition monitoring, digital image signal processing technology is the most basic application unit for intelligent and high-definition monitoring. Facing

more and more complex environment, in order to obtain accurate and clear image signal processing quality, certain measures and technologies must be taken. Especially in the development trend of intelligence and high definition, the image signal processing performance in image sensing technology directly affects the quality of the entire video system.

## References


[1] Ma W K, Bioucasdias J M, Chanussot J, et al. Signal and Image Processing in Hyperspectral Remote Sensing [From the Guest Editors]. IEEE Signal Processing Magazine, 2014, 31(1):22-23.

[2] Cai G R, Jodoin P M, Li S Z, et al. Perspective-SIFT: An efficient tool for low-altitude remote sensing image registration. Signal Processing, 2013, 93(11):3088-3110.

[3] Liu Q, Gao X, He L, et al. Haze removal for a single visible remote sensing image. Signal Processing, 2017, 137:33-43.

[4] Lee C, Johnson B, Molnar A. Angle sensitive single photon avalanche diode. Applied Physics Letters, 2015, 106(23):5897-1709.

[5] Jordan P, Colonius T. Wave Packets and Turbulent Jet Noise. Annual Review of Fluid Mechanics, 2013, 45(1):173-195.

[6] Delahoz Y, Labrador M. Survey on Fall Detection and Fall Prevention Using Wearable and External Sensors. Sensors, 2014, 14(10):19806-19842.

[7] Jovanovic N, Martinache F, Guyon O, et al. The Subaru Coronagraphic Extreme Adaptive Optics System: Enabling High-Contrast Imaging on Solar-System Scales. Publications of the Astronomical Society of the Pacific, 2015, 127(955):890-910.

[8] Mazin B A, Meeker S R, Strader M J, et al. ARCONS: A 2024 Pixel Optical through Near-IR Cryogenic Imaging Spectrophotometer. Publications of the Astronomical Society of the Pacific, 2013, 125(933):1348-1361.

[9] Alonso-Fernandez F, Bigun J. Near-infrared and visible-light periocular recognition with Gabor features using frequency-adaptive automatic eye detection. IET Biometrics, 2015, 4(2):74-89.

[10] Zdunek A, Kurenda A. Determination of the Elastic Properties of Tomato Fruit Cells with an Atomic Force Microscope. Sensors, 2013, 13(9):12175-12191.