Application of Digital Image Processing Technology in Spray

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Abstract: With the continuous development of social science and technology, the links between various industries are becoming more and more obvious. At present, digital image processing technology has become an indispensable technology in China's modernization construction, which is closely related to industries that need image processing, such as industry, communication technology, engineering and so on. In particular, the spray processing technology for images taken by high-resolution digital cameras has occupied an important position in modern life production. This paper will briefly summarize the digital image processing technology, analyze the status quo of its development, focus on its application in spray, and provide relevant reference and suggestions for relevant practitioners.

1. Introduction

Global economics has not only brought great economic development to China, but also satisfied people's current material needs and promoted the progress of major industries. At present, China's automobiles are still dominated by fuel oil. While causing pollution, they will also bring about a reduction in natural resources and lead to an energy crisis. Therefore, improving fuel efficiency is an important task for the development of automobile industry. Through digital image processing technology, the spray can spray fuel through the nozzle, forming small particles into the gas. The quality of spray directly determines the combustion efficiency. Therefore, improving the quality of spray can effectively increase fuel efficiency, and will bring considerable development to the automotive industry in the future.

2. Digital Image Processing Technology

2.1 Development and Application

Digital image processing technology records and processes important information such as brightness and color of image through data. Its earliest application was in processing images of the moon. With the development of the times and technology, this technology has entered the field of medicine and computer. At present, most image-related industries have used digital image processing technologies, such as military, film and television, archaeology, and chemical industry [1]. Digital image processing technology is used in spray operations because of its high resolution, high speed, three-dimensional and intelligent features.

2.2 Main content

The digital image processing technology mainly forms an image on the target object through the image sensor, and the digital processing is performed by the professional hardware, and then processed by the computer system, and the image is printed by using a printer or the like. The most important part is image processing, including image enhancement, image restoration and reconstruction, image segmentation, image compression and recognition, and image morphology processing. Through these steps, the picture can be processed better, and the spray characteristics and atomization are closely combined. The spray parameters are analyzed, the efficiency is improved, and the cost is reduced.

3. Image processing

In general, the edge of the shot image is not clear, so it needs to be processed by image processing technology. Using Matlab's excellent processing technology, the pictures are sequentially subjected to gray processing, contrast enhancement, filtering processing, image binarization and cone angle measurement to make the picture clearer and the analysis of the jet oil bundle more accurate.

3.1 Grayscale processing

Since natural light is composed of many different kinds of color light, when the oil beam is photographed on a black background, although the shape of the oil bundle can be clearly displayed, there are still other colors that interfere with the shape of the oil bundle, affecting the accuracy of the oil bundle image. [2]. Therefore, it is necessary to perform grayscale processing on the image, and divide the image into black and white colors from light to dark, thereby reducing interference of other colors in the natural light. After using Matlab to grayscale the image, not only can the original image's sharpness and light and dark gradient be guaranteed, but also the accuracy of the image color can be improved, which helps the oil beam to be measured and analyzed. In addition, the analysis work needs to be done when performing gray scale processing, and then the appropriate method is used to enhance the effect of software gray scale processing. In the grayscale mediation, it is necessary to make a reasonable adjustment according to the gray histogram. The grayscale processing of Matlab is performed by a certain mathematical expression in units of pixels in the image, such as $g(x, y)=T[f(x, y)]$. Where $f(x, y)$ represents an unprocessed image and $g(x, y)$ refers to an image that has been processed. T represents the degree of gradation processing on the pixel points (x, y). According to different images, T can be transformed and converted to the extent of gradation processing. In the process of processing, all the pixels in the original image are analyzed in the order of row priority and column postposition, and the pixels at the boundary are filled with different gray levels by T formula. On the other hand, the method of linear contrast expansion can be used for gray processing, which is suiTable for overexposure or inadequate exposure of the original picture. That is, in the case of insufficient contrast, the gray scale of the image is increased locally or globally by linear contrast expansion, and the clarity and local accuracy of the image are improved by enhancing the contrast. On the other hand, histogram equalization can also be used for gray processing of images. The gray range of the image can be expressed by $R(hk)=lk$, where HK represents the gray value at K level, and LK represents the gray value at the pixel points of hk. Histogram equalization is to transform the original image into another image with more uniform gray distribution through a certain gray level. Under suiTable conditions, it can differentiate the background and the image subject and improve the recognition degree by histogram equalization.

3.2 Contrast enhancement

In addition to natural light, the intensity, uniformity and sensitivity of light will affect the image. In particular, the reduction of edge details is particularly serious, which has a great impact on the later measurement and analysis. Usually, the photosensitivity of spray atomized particles is not excellent. Although the roughly shape of spray atomized particles can be identified after imaging, they can not be measured in the face of edge details. Therefore, the calculation of cone angle of spray atomized particles has a very serious impact. Therefore, to improve the quality of the details of the picture, increasing the contrast is a very effective method. After the contrast is increased, various tiny details in the image can be displayed, and the overall image is clearly visible, which is helpful for detection and analysis. As shown in Figure 1, before the contrast adjustment is made, the approximate outline of the image subject can be seen as three rays, from top to bottom, from fine to thick, but the details of the edges are very blurry and the details cannot be seen. After the contrast adjustment, the contrast between the subject's color and the background can be clearly seen, and at high contrast, the tortuous details of the edges of the three rays can be seen at a glance.

Fig.1. Effect of the original image after the contrast is increased

3.3 Noise point processing

Due to the influence of the shooting environment, the pictures taken more or less noise points, affecting the sharpness of the edge of the jet beam, affecting the accuracy of the staff detection and analysis. Therefore, after the shooting is performed, it is necessary to perform processing for removing the noise point on the original image. Such a processing method is called filtering processing [4]. According to different noise points, different filtering methods are needed. For example, for Gaussian noise points, the linear filter has better processing performance. The median filter can exert better effects in the face of salt and pepper noise. During the working process of the median filter, all the pixels in the original image need to be sorted according to the gray value, and the median values of the gray values are used to replace the pixels of the edge. When replacing, the median filter can select different shapes such as square, circle, diamond, and linear to replace the relevant area. On the other hand, mean filter is also an important technology in filtering processing. Compared with median filter, mean filter is the process of averaging the gray values of all the pixels in the region, and then replacing the pixels in the region that need to be changed. Mean filter can weaken the memory of noise points and reduce the amplitude of noise, but also increase its range. In addition, sharpening technology can also be used to process noise points. In the face of images with high signal-to-noise ratio, sharpening technology can be used to increase the high-frequency components and enhance the image sharpness. Therefore, before sharpening, the image needs to be de-noised to avoid adding noise points. When sharpening, we should use fspecial () to create and analyze the filter, and then use Filter2 () to process the filter.

3.4 Image binaryzation

Image binarization is to adjust the gray level of the image to the highest or lowest, so that the background and the main body of the image show two extreme colors respectively. Through the comparison of two different color pictures, it is helpful for staff to analyze the pictures quickly and locate the subject accurately [5]. After different gray processing and filtering processing, the edge and overall effect of the image are quite different from the original image. However, under the premise of accurate analysis, the image needs to be further processed to fully display the oil beam image. Therefore, image binarization can highlight the spray oil bundle under different background colors in two different colors, white and black, so that the spray oil bundle is clearly visible.

3.5 Spray cone angle measurement

The measurement of the spray cone angle is to measure the angle of the spray contour by a certain method. It is an important data to evaluate the atomization quality of the spray oil beam. Therefore, how to accurately measure the spray cone angle is of great significance [6]. After the original image is subjected to gradation processing, filtering processing and image binarization processing, the spray oil beam and the background can be clearly distinguished, and the boundary contour is clear. When measuring, it is necessary to determine whether the spray cone angle is near field or far-field. Facing the near field spray cone angle, it is necessary to calculate the angle between the nozzle and the middle point of the oil beam edge line. Similarly, in the far field calculation of spray cone angle, the angle between the nozzle and the edge line of the oil beam should be determined. By comparison, it is easy to find that the near-field spray cone angle has higher accuracy and can more accurately express the state of the oil beam.

4. Present Situation of Digital Image Processing Technology

At present, digital image processing technology is developing rapidly with the support of big data, computer technology and Internet technology. In the spray field, the image is accurately expressed by its own data, which meets the high accuracy requirement of the image in the spray field. On the other hand, through the processing of computer software, a series of images can be processed to improve the accuracy of the data, and to meet the needs of spray work and ensure the quality under the condition of increasing working pressure. In the future work, digital image processing technology needs to be developed intelligently. Faced with different spray images, computers can be intelligently processed based on a large database of big data. The image processing is completed in the shortest time and self-analysis is performed. Only by developing in this direction can we bring its efficiency to the utmost and bring greater economic benefits to enterprises and countries while saving a lot of costs.

5. Conclusion

In today's rapid economic development, the quality of fuel atomization directly determines the efficiency and cost of national production. High-quality fuel atomization can not only help related industries to produce better and faster, but also help to save costs, increase profits, bring greater economic benefits to the country, and increase the speed of economic development. Therefore, the research, analysis and improvement of fuel spray technology is the most important research work of relevant employees. Using modern digital image processing technology, the fuel spray image is intelligentized and a series of image processing are carried out. Through accurate analysis, we can find the existing problems, find reasonable solutions, further improve the quality of fuel atomization, and make due contributions to China's economic development.

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