

Correlation Analysis between Mechanical and Electronic Engineering and Artificial Intelligence Based on Color Features

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Abstract: There are physical correlations among various disciplines of mechanical engineering, and there is also the co-integration of information and functions. For the development of enterprises, more and more attention is paid to improving the automation level of mechanical design. Color is the simplest and most effective feature to describe an image. Compared with other image features such as shape and texture, color has certain stability, is insensitive to direction and image size, shows strong robustness, and is relatively easy to extract. In the process of practice, we should give full consideration to the application and functional characteristics of mechanical and electronic engineering and AI (Artificial Intelligence), so as to promote the research work of their correlation to achieve the expected results. Based on this, this paper will analyze the correlation between mechanical and electrical engineering and artificial job intelligence.

1. Introduction

In recent years, AI (Artificial Intelligence) technology has become increasingly mature, and mechanical and electronic engineering has also realized the connection between information function and physical structure, which is developing in the direction of informationization and intelligence, and the organic combination between them is getting closer and closer, which greatly promotes the social progress and economic development [1]. Therefore, in the process of accelerating the development of mechanical and electronic engineering and AI, it is necessary to consider from different angles and pay attention to the correlation analysis between them, so as to ensure the good practical application effect of mechanical and electronic engineering and AI.

2. Mechanical Engineering and Ai

2.1 Related Concepts of Mechanical Engineering

Based on the design level, compared with traditional mechanical engineering, mechanical and electronic engineering is very interdisciplinary and comprehensive, and it is a kind of discipline formed by integrating the excellent parts of various types of disciplines [2-3].

In the process of implementing the design link of electronic engineering, mechanical engineering is the main focus, and computer technology and electronic engineering are well connected at the same time, and other disciplines and technologies are integrated according to the different configuration systems and objectives. This is an interdisciplinary attempt, but also a challenge. It can analyze all mechanical engineering information to achieve the purpose of intelligence [4]. Although it still belongs to the mechanical engineering industry, it obviously has its own characteristics.

After many years' development, the mechanical and electronic engineering industry has formed a certain system, and has merged with modern science and technology to a certain extent, and entered the stage of modern mechanical and electronic development. In the final analysis, the development of mechanical and electronic engineering is to meet the needs of social work and life. In modern

society, the pace of work is accelerated and production is more flexible, which puts forward higher requirements for mechanical and electronic engineering. The mechanical and electronic industry is characterized by flexible manufacturing, which also creates conditions for the integration of mechanical and electronic with information society.

2.2 Artificial Intelligence

In the process of studying AI, it is necessary to strengthen the connotation analysis in its practical application [5]. Specifically, the so-called AI refers to the analysis and summary of the characteristics and laws of human production activities. With professional technical and theoretical support, the construction of artificial system with remarkable intelligent characteristics has been realized. That is to say, some human behaviors can be simulated and analyzed and applied under the action of different elements such as computer system and information technology.

AI has the following characteristics. On the one hand, because AI is integrated by multiple disciplines, it determines its complexity and professionalism, and it needs more professional technology to promote its development in a better direction [6]; On the other hand, the specialty of disciplines also puts forward higher requirements for AI talents. Only those who have solid professional knowledge and are inclusive of other disciplines can truly be competent for AI-related work.

3. Color Feature Extraction

The pre-processing of the image is to weight the pixels according to the distribution of colors in the image, and this weight can reflect the degree of color change in the local area where the pixels are located. According to the weight of each pixel, the color change intensity of the whole image can be calculated. The greater the intensity, the greater the degree of color change in the image and the smaller the intensity, indicating that the color change in the image is smoother.

For some two colors, this distance makes people feel that the color perception is quite different, but for the other two colors with the same distance, it may make people feel that the difference is very small [7]. When clustering and quantifying colors, it is necessary to describe the difference between colors with quantity, which is called chromatic aberration for short, so RGB color space obviously cannot meet the requirements.

Let any pixel point $f(i, j) = X$ in the image, where X is a three-dimensional vector, contain three components L, a, b of color. Then compare the color values of all pixels in the neighborhood of $W \times W$ rectangle with (i, j) as the center with the center pixel, calculate the difference between them by Euclidean distance, and arrange them in order from small to large to get a sequence of difference:

$$d_k = \|f(i, j) - f(g, h)\|, (g, h) \in S$$

$$d_0 \geq d_1 \geq d_2 \geq \dots \geq d_k, k = W^2 - 1 \quad (1)$$

In which S represents all pixel point sets in the neighborhood of $W \times W$ rectangle with (i, j) as the center.

In the sequence of the above formula, the first difference corresponds to the pixel at the central position, and the last difference corresponds to the pixel in the neighborhood that is the least similar in color to the central pixel. According to this sequence, all pixels in S are numbered to obtain a pixel point set:

$$\{X_0, X_1, \dots, X_k\}, k = W^2 - 1 \quad (3)$$

Among them, X_0 is the center pixel, and X_k is the least similar point with the color of the center pixel. The homogeneous point set of the center point is selected from the sequence of formula (2). In this sequence, pixels that are not similar in color to the central pixel need to be removed.

4. Correlation Analysis

4.1 Ai Improves the Precision of Mechanical and Electronic Engineering

Because of the instability of electronic system, its development slows down. For the field of mechanical and electronic engineering in our country, we must do a good job of data processing, and only in this way can we gain the trust of our nationals. It can be concluded that the application of mechanical and electronic systems has been hindered. It also hinders the development of AI in the field of mechatronics.

With the emergence and use of AI, the data of mechanical engineering is strictly controlled, and its accuracy is gradually improved and improved. However, in order to achieve the goal of accurate mechanical engineering data, there will still be some fluctuations and different changes in the data. These subtle changes need to be constantly adjusted and improved manually in order to achieve the ultimate goal of mechanical and electronic engineering.

4.2 Relevance in System Modeling

Fuzzy system and neural network play an active role in building complex system models. Among them, the neural network processes various types of digital signals of the system by simulating the neural structure of the human body, while the fuzzy logic system processes the digital signals by imitating the functions of the human brain [8]. According to the study of neural network, it can be known that in the process of information output, because the relationship between neurons is invariable, the amount of calculation is very large, while the relationship between modules in fuzzy logic system often changes, so the amount of calculation is very small.

When comparing images, histogram phase change algorithm can be used to calculate the distance between histograms. Assume that Q, P is two histograms quantized by D dimension, and the distance between them is expressed as:

$$dist = \sum_{i=0}^{D-1} \min(P_j, Q_i) \quad (3)$$

For the convenience of calculation, its unit is:

$$S(P, Q) = \frac{\sum_{i=0}^{D-1} \min(P_j, Q_i)}{\sum_{i=0}^{D-1} \min Q_i} \quad (4)$$

If the nonuniformity of color space division and people's visual characteristics are considered, quadratic distance can be adopted:

$$dist = (P - Q)^T A (P - Q) \quad (5)$$

A is a color similarity matrix, which can be obtained according to the similarity factors between similar but different pre-colors. The corresponding similarity matrix should be established according to the actual situation.

Among the methods adopted to build AI system, neural network system and fuzzy reasoning system are mainly used. Neural network system can simulate human brain structure, analyze digital signals and give reference values. The fuzzy inference system can effectively analyze language signals by simulating the functions of human brain. In dealing with the relationship between input and output, these two methods have both similarities and differences.

The introduction of fuzzy neural network, and then better integration, ultimately effectively improve the operability of mechanical and electronic engineering product design. In addition, it should be noted that both neural networks and fuzzy logic systems can approximate a continuous function with arbitrary precision. But there are significant differences between them.

5. Specific Application

5.1 Fuzzy Inference System in Mechanical Technology

As a relatively complete system, fuzzy reasoning system has strong information processing ability and simple structure, so it has strong practicability [9]. At present, the fuzzy reasoning system has been widely used in the society, which is mainly used in automatic control and data processing. When the mechatronic system is running, the system will simulate the human brain analysis language and issue processing instructions, which will produce a set of functions relative to the processing instructions in the network structure.

Usually, only those colors with concentrated distribution in an image leave a deep impression on people, and these colors can best reflect the main content features of the image. Therefore, when distinguishing the spatial distribution of the main colors by moment features, it will be more accurate to consider the distribution of the main colors at the same time, that is, the weight of each main color region.

In order to remedy this defect, it is necessary to uniformly change the gray scale of the image, and stretch the gray scale interval in the image to the whole gray scale interval to enhance the contrast. V_{\max}, V_{\min} is the maximum value and minimum value of gray level respectively. For convenience, the dimension of gray level histogram needs to be consistent with that of color histogram. The change can be obtained by the following formula:

$$v = (V_{\max} - V_{\min} + 1) * v / D \quad (6)$$

Where D is the dimension of the color histogram.

Fuzzy reasoning system is mainly used from domain to domain to achieve the purpose of reserving information rules. However, there are also some problems in actual operation, such as: the amount of calculation can not meet the actual needs, the connection mode is not fixed enough, etc., which leads to errors in the input and output links of the system, which is the advantage of AI technology. The current trend is to integrate AI neural network system into electromechanical fuzzy reasoning system to learn from each other's strengths and make a comprehensive application.

5.2 Automation of Electronic Mechanical Engineering

In recent years, with the progress of science and technology and the deepening of people's research, robots gradually appear in people's field of vision. As its name implies, robots can replace manpower. Its main function is that people can press the corresponding instruction keys to make robots do the corresponding work, so that mechanical and electronic engineering no longer depends entirely on manpower. The emergence of robots not only solves a lot of labor for enterprises, but also saves a lot of labor costs.

Through the analysis of the two, it can be seen that the relationship between them is very important and can produce good results. The application of AI also improves the accuracy of electronic engineering.

It can be seen from fig. 1 that the effect of the global cumulative histogram method is the worst, and there is a big fluctuation, which is caused by the addition of many interfering images in the image database. Because of these interferences, the retrieval results will not show that the precision curve of global histogram is better than that of block method. It can also be seen from the curve in the figure that the average precision rate of the correlation feedback method and the genetic algorithm is basically equal, while the curve of the genetic algorithm is smoother, indicating that this method is more stable.

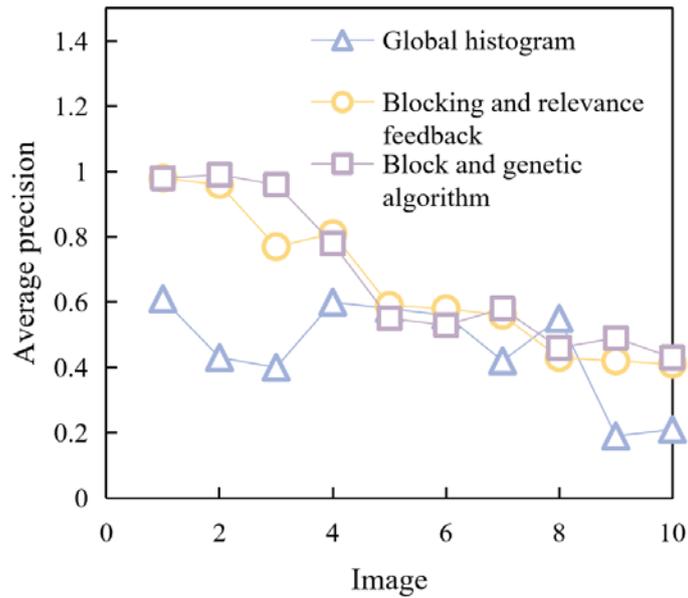


Fig.1 Average Precision Curve

General analytical methods are precise and accurate, but their application range is very limited, and they can only be applied to simple systems. However, for complicated systems, they cannot provide complete analytical formulas, and they must rely on manual operation. With people's higher requirements for the system, the processed information becomes complex and diverse, and the content of information includes not only the form of data, but also new forms such as digital information and language information.

6. Conclusion

The application prospect of AI technology is bright. But to achieve large-scale popularization, it needs long-term efforts. At present, the application of AI technology is only a small part, and most of them are still in the theoretical stage. With the continuous development of science, not only is the discipline highly refined and deepened, but also it is a high degree of integration among disciplines. Color is the basic component of image content, and it is one of the main perceptual features for people to recognize images. Histogram is a method widely used by many image retrieval systems, which describes the proportion of different colors in an image. AI is the result of the cross and synthesis of various disciplines. Adhering to this nature, AI and mechanical and electronic engineering are naturally and perfectly integrated. The development of this new field will surely lead the world trend and promote the rapid development of productivity.

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