2018 International Conference on Virtual Reality and Intelligent Systems

Computer Vision Imaging Based on Artificial Intelligence

Li Xin [1]，Shi YiLiang [2]

[1]Faculty of Information Engineering,City College, Wuhan University of Science and Technology

*E-mail:418735458@qq.com

***Abstract*—In order to study artificial intelligence-based computer vision imaging, computer technology was used to efficiently and accurately obtain relevant information from environmental images or videos. Things and phenomena in the objective world were analyzed, judged, and decided. Based on biological vision and physical models, the basic methods and approaches of computer vision were explored. The contents of evolutionary calculations, pattern recognition, biological vision, and surface defects detection of slabs were studied. A computer vision system with high adaptability, high accuracy, and rapid response was developed. The results showed that the evolutionary calculation methods were diverse in form and versatile. Therefore, it can be applied in many aspects of computer vision, and its performance is very good.**

Keywords-Artificial intelligence; computer; vision; imaging

I. INTRODUCTION

In daily life, vision is often used to observe things and the environment to obtain relevant information. Although vision is a basic and common ability for normal people, the process and principles of visual system completion are complex (Rautaray and Agrawal, 2015).

Computer vision can simulate human vision. Computer software and hardware are used to analyze and process visual information and data. It includes the process of acquiring, transmitting, processing, screening, storing and understanding visual information (Lemley et al., 2017). From the image or image sequence, the knowledge and understanding of the external world is acquired, and the relevant information of the object is collected.

Computer vision is based on computing devices and computing. Research on computer vision and artificial intelligence needs further breakthroughs. The study of computational theory can guide the research of computer vision, and various applications provide a good background and platform for the study of computer vision (Esteva et al., 2017). Based on biological vision and evolutionary computation, the method of improving self-adaptation of computer vision is studied.

II. STATE OF THE ART

In 1989, Holland's student D.E. Goldberg published a monograph (Gonzalez et al., 2016). The book summarizes the main results of genetic algorithm research. Genetic algorithms and their applications have been comprehensively and systematically discussed. In the same year, Koza of Stanford University in the United States creatively proposed a genetic programming method that uses hierarchical computer programs to express problems based on the principle of natural selection (Wang et al., 2015). It successfully solved many problems. In 1995, Koza published his monograph, which deepened the research of genetic programming and enabled the automation of programming to show a new situation (Wang et al., 2017). In 1997, JF Winkele used genetic programming for the identification of target objects (Patel and Chatterjee, 2016). In 2008, Perez et al. studied the application of genetic programming in embedded hardware.

III. METHODOLOGY

A. Basic theory of evolutionary computing

Based on the computational model, characteristics, and capability limitations of the Turing machine, the evolutionary kinematics model and the evolutionary computational dynamics model are proposed, and the characteristics and capabilities of the evolutionary calculation are analyzed. It prepares for the implementation of computational intelligence and computer vision based on evolutionary computational models (Greenspan et al., 2016).

Computer vision is the use of computers and computing to obtain visual functions. The theory of computation originated from the study of basic problems in the field of mathematics. It is one of the theoretical foundations of computer science. In recent years, new calculation methods and techniques such as chemical calculations, biological calculations, and quantum calculations have emerged. These methods and technologies will greatly improve information processing capabilities. The limitations of models, characteristics and capabilities based on Turing machines are analyzed. The characteristics and ability of evolutionary computation are discussed. It is pointed out that the evolution calculation does not belong to the Turing machine. Its computational capabilities go far beyond the computing power of Turing machines [5].

Turing machine and judgment: The Turing machine has always been considered as an accurate model of any physical computing device. It is generally regarded as a general model of modern computers. The number of all Turing machines and the number of all problems are different. Only countable, small and ordinary problems are solved by Turing. There are many problems that Turing can't solve. The language that the Turing machine does not recognize is much more than the language that the Turing machine can recognize [6].

Calculations and evolution calculations: Evolutionary computation is the expression and generation of information in the interaction between the system and the environment. Evolutionary computing can solve a variety of problems. It takes place with human intervention. Among these problems, the classical calculation process is different from the evolution calculation.

The classical calculation of the problem is as follows. The first step is to analyze the problem. The second part is

978-1-5386-8031-5/18/$31.00 ©2018 IEEE
DOI 10.1109/ICVRIS.2018.00014

the human design algorithm. The third step is to solve the problem after the algorithm is implemented.

The process of evolutionary computation to solve the problem is as follows. The first step is to analyze the problem. The second step is the human design evolution system. The third step is evolutionary system evolution in the environment. The fourth step is the evolution of the system to solve the problem.

It is of great significance to study the possibility of information generation and information generation methods in evolutionary systems. Evolutionary system designers can enter information directly into the evolution system in some way, but this is not the evolution of the system to generate information. The induction and deduction of information cannot generate new information.

The classic calculation is shown in Figure 1. The evolutionary calculations are shown in Figure 2.

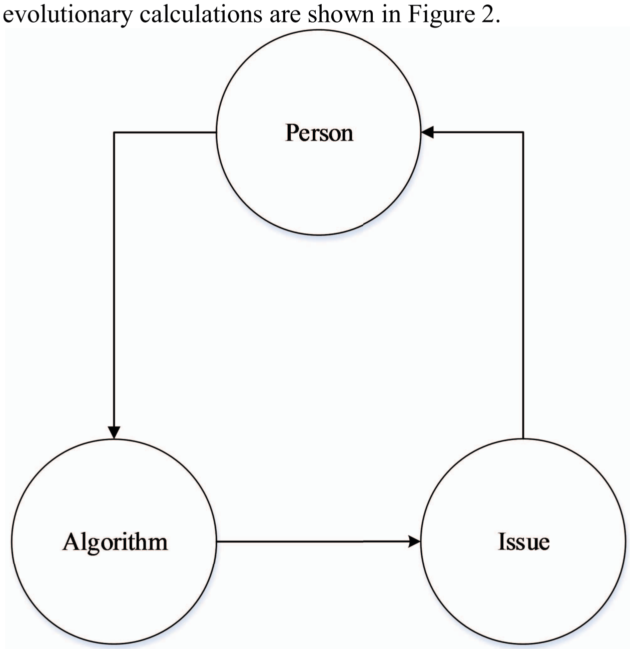

Figure 1. Classical calculation

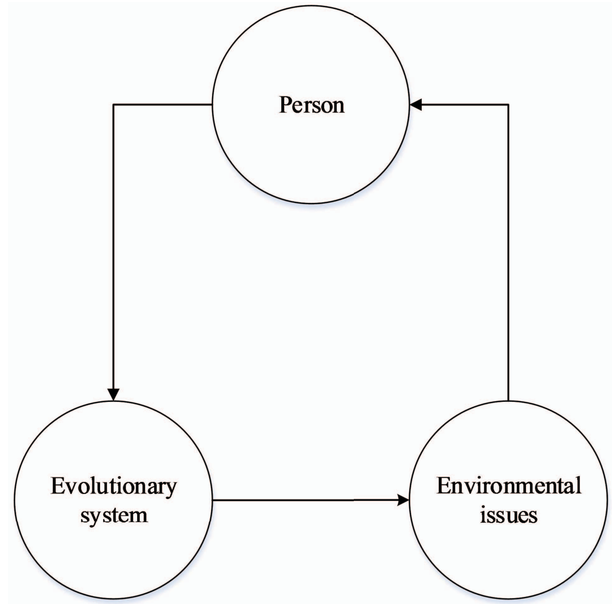

Figure 2. Evolutionary calculation

B. The dynamic model of evolutionary computation

Evolutionary automata model: The evolutionary state machine ESA is more expressive than the Turing MachineTM, which is a more fundamental way of using physical computing devices.

Evolutionary computational model: The uncertainty of data and computation is the source of information generation, which is the basic driving force of evolutionary computation. Data can be interpreted as information that can influence or even determine the calculation. The fundamental power of evolutionary computation comes from the increase of information, as shown in Figure 3. The uncertainty of data and calculations makes the information in the system more likely to increase. The added information can be spread, superimposed, and accumulated. The system develops toward the direction of complication and intelligence. The characteristics of the evolutionary Turing automaton model are as follows. The introduction of data generation mechanisms includes random and chaotic. In addition, it is derived from the environment. The changes of the system include state control and number of states, control of transfer functions and so on.

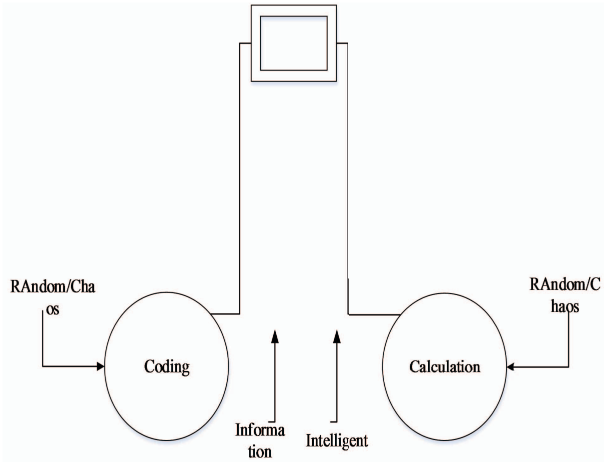

Figure 3. Evolutionary computation "single pendulum" model

C. *Pattern recognition based on evolutionary computing*

Pattern recognition uses various sensors as sources of information. The core of theoretical technology is information processing and pattern recognition. Mathematical methods and computers are the main tools for exploring ways to process, classify, and understand various media information. Pattern recognition is widely used. The basic structure of pattern recognition system is shown in Figure 4.

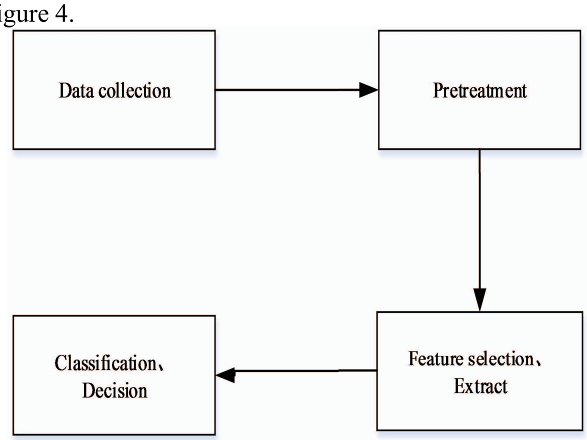

Figure 4. The basic structure of pattern recognition system

The basic ideas and steps of statistical pattern recognition based on evolutionary computation are as follows. The first step is to determine pattern-related features and form feature sets. The second step is to determine the range of values for each feature. The third step is to determine the legal solution space. The fourth step is to determine the initial state or group. The fifth step is to determine the evaluation function. The sixth step is to determine the evolutionary strategy of the solution. The seventh step is to determine the evolution termination conditions. The eighth step is evolutionary solution. The ninth step is to end the calculation.

The description of primitives, the choice of primitive relations, and the extraction of primitives and relationships have limited the identification of structural patterns. Therefore, the evolutionary calculation method is introduced into the structural pattern recognition to achieve the effect of increasing adaptability, flexibility, and improving efficiency. The primitive frame and primitive parameters were introduced into the primitive design in the primitive description. The primitive is designed to be a variable, more expressive structure within a certain range. Primitive entities are generated during program learning or training. In the selection of primitive relations, using the description of the goal of the primitive, a part of the description is determined, which is designated by the programmer. The other part of the dynamic blurring can define the framework, which is generated by program learning or training. In the extraction of primitives and relationships, a sequential variable relation extraction method is designed to specify the evaluation function of the primitive extraction efficiency.

IV. RESULTS AND DISCUSSION

The study of biological visual perception includes computer vision. It uses the known laws of biological vision and evolution calculation methods to study computer vision. Inspired by the rule of biological vision, a visual perception model based on evolutionary computation is established. Computer vision with greater learning ability and human adaptability is achieved. By using the perceptual model based on evolutionary computation, the phenomena and rules in biological vision are interpreted and discovered. The method of evolutionary computation is introduced to achieve primary visual feature extraction and perceptual organization.

A. *Principal component analysis*

Principal component analysis (PCA) is a technique based on unsupervised learning that analyzes and simulates data. PCA has extensive research in neuroscience and computer vision. In order to effectively apply the principal component analysis method in computer vision, the method is improved and the evolutionary calculation method is introduced. The data and principal component selection of the principal component analysis method are dynamically adjusted to achieve the purpose of increasing visual information processing flexibility.

B. *Visual computing model of hierarchical parallel evolution*

There are three kinds of visual models, namely template model, prototype model, and feature model. The model requires a large number of templates and requires an extremely fast template search capability, which is difficult to satisfy. The prototype model has lower requirements for memory storage. The working cycle is also more flexible. However, there is no clear and concrete description of how the external stimuli are abstracted and the structure of the internal characterization and prototype is established. The feature model reveals the concatenation and parallelism of visual processing but lacks an evolving expression. Therefore, a hierarchical parallel evolution computing model is proposed:

First, visual cognitive and learning functions are produced by evolutionary computing systems.

Second, visual computing systems consist of evolutionary primitives in series and in parallel.

Third, the evolution primitives consist of four parts: input and selection module, processing and selection module, output and selection module, and excitation input. Among them, the first three parts are self-adaptive. It is evolvable. The maximization of the incentive input is the goal.

Fourth, the input of each evolution element comes from the whole evolutionary computation system.

The hierarchical parallel evolutionary computation model processing process is generally hierarchically progressive. It is divided into data acquisition and selection, primary visual processing, intermediate visual processing, and visual organization. The relationship between multiple evolution primitives involved in each visual processing function is different from that of cooperation and competition. The research on the hierarchical parallel evolutionary computation model mainly includes:

Input data selectivity assumptions: When studying vision, all data do not need to be processed and responded. Important data are used to drive large amounts of other input data. This choice can occur in a simple mode at the beginning of the visual, that is, data entry. The hypothesis of the selectivity of input data for biological vision is proposed. At the time of data entry, biological vision has a screening or prioritization mechanism macroscopically and microscopically.

Improved sparse coding research: The essence of sparse coding is that simple cells respond to certain features of vision in the visual field of vision. In order to verify the possibility of input data selectivity assuming computer vision, an input data selection mechanism was introduced in the sparse coding method. Improved sparse coding methods and related artificial neural networks were designed. This method was applied to the defect classification of the surface of the slab. The experimental results show that the information extraction mechanism in the visual information processing process can not only occur in the data processing process but also can effectively filter data during the data input stage. This mechanism greatly reduces the computational complexity of sparse coding. It has little effect on the treatment effect.

C. *Manifold learning based on evolutionary computation*

Manifold learning is divided into global methods (such as ISOMAP) and local methods (LLE, LE). Manifold learning re-presents a set of data in high-dimensional space in low latitude space. The purpose is to find out the inherent regularity of high-latitude data distribution. The basic idea is as follows. The points in the high-dimensional observation space are co-acted by a few independent variables, and they form a manifold in the observation space. If the spatially-curved manifold of the observation space can be effectively expanded or the main internal variables are found, the dataset can be dimensioned.

V. CONCLUSIONS

In the water resources ecological indicators, water conservation and drinking water are full in marks, from which it is seen that university A effectively implements water conservation policy, and reasonably builds drinking water quality monitoring and management system, but efforts in the use of recycled water and waste water treatment are not enough. In terms of educational investment indicators, College A is excellent in education funding and library collection, both for full mark. In the case of relatively strict index calculation formula, teaching resources of College A are rich. At the index level, only the average classroom area index score is low, 78.3 points, but from the results of the literature collection, the index is still a higher level in domestic.

REFERENCES

[1] Rautaray, S. S., & Agrawal, A. (2015): Vision based hand gesture recognition for human computer interaction: a survey. Artificial Intelligence Review, Vol. 43, No. 1, pp. 1-54.

[2] Lemley, J., Bazrafkan, S., & Corcoran, P. (2017): Deep Learning for Consumer Devices and Services: Pushing the limits for machine learning, artificial intelligence, and computer vision. IEEE Consumer Electronics Magazine, Vol. 6, No. 2, pp. 48-56.

[3] Esteva, A., Kuprel, B., Novoa, R. A., Ko, J., Swetter, S. M., Blau, H. M., & Thrun, S. (2017): Dermatologist-level classification of skin cancer with deep neural networks. Nature, Vol. 542, No. 7639, pp. 115.

[4] Gonzalez, L. F., Montes, G. A., Puig, E., Johnson, S., Mengersen, K., & Gaston, K. J. (2016): Unmanned Aerial Vehicles (UAVs) and artificial intelligence revolutionizing wildlife monitoring and conservation. Sensors, Vol. 16, No. 1, pp. 97.

[5] Wang, Z., Kieu, H., Nguyen, H., & Le, M. (2015): Digital image correlation in experimental mechanics and image registration in computer vision: similarities, differences and complements. Optics and Lasers in Engineering, Vol. 65, No. 5, pp. 18-27.

[6] Wang, K., Gou, C., Zheng, N., Rehg, J. M., & Wang, F. Y. (2017): Parallel vision for perception and understanding of complex scenes: methods, framework, and perspectives. Artificial Intelligence Review, Vol. 48, No. 3, pp. 299-329.

[7] Patel, A. K., & Chatterjee, S. (2016): Computer vision-based limestone rock-type classification using probabilistic neural network. Geoscience Frontiers, Vol. 7, No. 1, pp. 53-60.

[8] Greenspan, H., van Ginneken, B., & Summers, R. M. (2016): Guest editorial deep learning in medical imaging: Overview and future promise of an exciting new technique. IEEE Transactions on Medical Imaging, Vol. 35, No. 5, pp. 1153-1159.