The Application of Conditioned Reflex Mechanism in Cybernetics is Studied Based on Computer Aided Technology

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Abstract. Through the introduction of cybernetics, this paper introduces in detail the course of cybernetics in the development of society and science, and briefly expounds the dispute over the status of cybernetics in the development of science and technology, which leads to the inseparable relationship between cybernetics and modern intelligent machines. Finally, based on the computer-aided discussion of the simulation of biological conditioned reflex mechanism by industrial machinery under the background of cybernetics, the irreplaceable position of cybernetics in the development of technology is obtained, and the application of the conditioned reflex mechanism in the future is made a bold assumption according to the prospect of the development of computer.

Keywords: Cybernetics, Conditioning, Reinforcement Learning, Computer Aided Technology

1. Introduction

It has been nearly 70 years since Weiner published his first book on cybernetics. Later, the world's best experts and scholars from different fields organized and participated in the Macy's cybernetics conference, put the basic principles of cybernetics into practice in everyone's deep-seated projects, then summed up more detailed theories, summed up more practical experience, and made the best efforts for the development and improvement of the industry and cybernetics, and their research was arduous and outstanding in the process of promoting society and science, but little known. With the development of cybernetics in two decades, some disciplines have been developed rapidly, and some branches of disciplines have taken root and sprouted among them. These branches continue to grow and are gradually away from the original disciplines. New things are always hot spots for speculators and the media, and cybernetics is no exception, but speculators and the media only care about its freshness and mysterious appearance, and know nothing about its inner core and the profound influence it will have on all fields. When cybernetics are rarely mentioned in the everyday world, the
true explorers are still on the road to cybernetics, finding ways to raise funds, study in depth, teach students, only to look forward to the future of cybernetics. At the turn of the twenty-first century, the much-forgotten cybernetics have been revived by the past \cite{1}. Neither the first cybernetics, nor the many scholars and experts who have worked hard for it, have been eclipsed by the prosperity of cybernetics, which, one by one, look like tragic heroes, giving without the recognition and attention of the times. However, with the rapid progress of computer technology and basic industry in the mutual promotion, artificial intelligence technology and robot technology have been developed by leaps and bounds, the function displayed in practical application has brought people unprecedented wonderful experience, and the use of machines instead of living things to do more and more things to make life more convenient, richer, more controllable, has aroused the interest of all mankind. It is also at this time that cybernetics, as a bridge between living things and machines, once again became the object of study. Among them, conditioned reflex, as a way of coping with the changes and stimuli of external environment formed in the long-term evolution of organisms, has become the basic research material for the establishment of cognitive model of perceptual motor system. It also provides all the research materials of biological principles for automatic learning machine bionic learning and reinforcement learning in the era of machine deep learning. On its own, cybernetics seems useless, but when all disciplines are placed in this world, cybernetics seems to be the "God" that makes every discipline a component of the whole machine, and finally assembles into an efficient machine, the world we are now \cite{2}. Due to space limitation, this paper only studies the application of conditioned animal conditioned reflex instinct in human-made machines under the guidance of cybernetics.

2. The positioning of cybernetics and its scientific significance

2.1. The scientific orientation of cybernetics

All along, that is to say, since the theory of self-control was put forward, it is not only the world of the masses, but also the world of experts. There are probably two kinds of positioning of cybernetics, one is the narrow understanding and positioning of cybernetics, the other is the opposite, for the broad understanding and positioning of cybernetics. In a narrow sense, it is generally believed that cybernetics is not born out of nothing, but actually exists in the control systems of various modern industries and machines, and is widely used even in many families, but this existence is abstract, and the existence of cybernetics in it is more like an invisible hand that properly assembles different disciplines together. People with hold a broad view do not think so; they believe that cybernetics is as fundamental as physics, and is widely used and irreplaceable in the study of society and nature. There is a figure of cybernetics in all the disciplines we study. It is inevitable that although we did not realize its existence before it was introduced. Its existence in all research and cognition was objective and did not change in the slightest with human subjective knowledge or ignorance.

2.2. The basic principles of conditional reflection in cybernetics

Conditioned reflex is also called Pavlov conditioned reflex. It was first proposed by Pavlov, a Russian medical physiologist who has been many innovative experiments to study the relationship between neural mechanisms and biological behavior and has been the pioneer of the study of biological conditioned reflex for more than a hundred years. Nowadays, conditioned reflex has been widely used in practice.
(1) Principles of evolution and adaptation. In the process of natural development and change, biological survival will be tested in various ways, including slow environmental change test and sudden external environmental change test. The ability of biological species to evolve to adapt to long-term and short-term changes in the environment is essential for survival and development. In the machine is reflected in the machine's adaptation to the environment. (2) Principles of learning and intelligence. Biology is learning all the time in the process of group history evolution and individual life, some learning is active, others learning is unconscious instinct. In the process of continuous learning, the body and intelligence of the organism have changed and passed on generation by generation. In intelligent machine learning, it is to imitate the neural mechanism of organism to make the machine have autonomous learning, reinforcement learning and deep learning according to calculation and logic.

3. Sensory motion system model based on conditioned reflex

To realize the similar adaptability of bionic machine by using biological conditioned reflex, it is the basic work to establish the model of sensorimotor system. For organisms, the same tissue system is called neural tissue, and its composition and interrelation are shown in Figure 1[3]. These corresponding parts are integrated in the machine to achieve the purpose of control, among which the most difficult to achieve is to compare and cross-analyze the information obtained by each part from the outside world, and finally get the optimal response to environmental stimulation action on the basis of fuzzy analysis, so as to achieve the purpose of machine application.

![Figure 1. Neuro-structural structure of sensory motor system](image)

4. Application of conditioned reflex mechanism in cybernetics

To make machines learn as much as biology, the first thing to solve is to achieve structural similarity or even consistency. The practical process of using learning automata to show the theory of conditioned reflex is that artificial machine system shows self-learning iteration similar to animal learning in psychodynamic[4], conditioned reflexes and learning automata play different roles in a unified organism. These two applications show that machines are extremely similar to animal conditioned reflexes.

4.1. Automatic learning

The process of automatic learning reflects Thorndike's trial and error. In order to be more
straightforward and easy to understand, here is a simple description of the learning automata itself environment, because of the variability and uncertainty of the environment, such as learning automata machine running environment is random, expressed in the following set:

$$LA = <t, S, \alpha, \beta, F, G, A>$$ (1)

The $t$ is discrete time in the set. $S$ represents all possible states within the machine. $\alpha$ is a set of all possible action states and $\beta$ is external stimuli. $F: S^* \beta \rightarrow S$ is a function that maps the current state with the input to the next state, which can be deterministic or stochastic, $G: S \rightarrow \alpha$. $G$ is a function $p$ mapping the current state to the output based on the probability of occurrence. On the basis of the probability of change of $\alpha$ and $\beta$, the corresponding behavioral action $A$. obtained by calculating the neural mechanism similar to that of animals[5]. The automatic learning process under the conditioned reflex mechanism is shown in figure 2.

**Figure 2.** Automatic learning processes under conditioned reflex mechanism

4.2. Intensive learning

Reinforcement is an inevitable concept to talk about conditioned reflex [6]. The process of reinforcement is simple, that is, to impose an external or environmental stimulus on the target object to increase the probability of the target object making predictable results. In Skinner's experiment, there are shadows everywhere that induce target behavior by reinforcement. Reinforcement can be divided into positive reinforcement and negative reinforcement. Whether the machine is strengthened positively or negatively depends on the reality's need for the target behavior. In the application of reinforcement learning in conditioned reflex to machine, we should also simulate the output behavior of different input stimuli under the physiological and psychological action of animals, and use the loop algorithm of enhanced stimulation to improve the probability of the occurrence of target behavior in order to achieve the desired purpose. In this process, there are three key variables physiological changes, psychological changes and energy changes to respond to stimuli should set the corresponding algorithm mechanism when designing the machine. Reinforcement learning under conditioned reflex
mechanism is shown in figure 3.

![Figure3](image-url)

Figure3. Schematic diagram of reinforcement learning under conditioned reflex mechanism

5. Conclusions

Human cognition of science is deepening day by day, artificial intelligence technology is developing rapidly, robot learning ability is constantly strengthened, and the mutual reference, mutual penetration and fusion between them have greatly expanded the field of people's research, but also gave birth to other disciplines [7]. In the process of technology integration, cybernetics always exists as a kind of thought behind it, it does not participate in any specific technological change, but its guiding role in macro-technology resource allocation and technology development direction is beyond doubt. This paper is to study the application of conditioned reflex in modern intelligent machine and robot technology in cybernetics background, and draw lessons from different starting points and end points in the context of conditioned reflex of Pavlov, Thorndike and Skinner, so as to achieve the purpose of realizing human demand through design algorithm. In the future, with the closer integration of cybernetics with conditioned reflex mechanisms and the more developed biotechnology, industrial technology and computer technology, we can expect a machine that predicts the future through complex algorithms, let's wait and see.

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