A SOVIET REPORT ON THE AMERICAN "CONFLEX" SYSTEM

[Following is the translation of an article originally entitled "A Machine Identifies an Image," by Engr-Col M. Goncharenko, as published in the Russian-language newspaper Sovetskiy patriot (The Soviet Patriot), Moscow, 16 August 1964, page 3.]

At present, the high-speed cybernetic machines are being widely used in the various areas of science and technology. They have reached phenomenal speeds in developing accounting. Thus, for example, one of the modern machines is capable of doing more than one billion computations in a working day. And the accuracy of the computations is exceptionally high.

Promising results have been achieved also in designing special-purpose machines. Thus, they have already built experimental models of "learning" machines. The basic distinction of the learning machines against the electronic computers is that they do not have a preset programming. The programmed actions, as is known, are reduced to the automatic solution of a definite problem by the control signals, the commands. The aggregate of commands and numbers is the program. The learning machines work out their own program for recognizing signals in the process of a repeated training of a "memory" to recognize and remember images.

In passing through a "training" course, such machines imitate certain functions of the human brain and are fully capable of automatically recognizing images, of reading printed and written texts, of distinguishing speech, and also carrying out other tasks.

The chief property of human memory is, as is known, its readiness, that is, the ability to rapidly withdraw from the accumulated stock of remembered information precisely what is necessary at the given moment. The goal of creating the learning machines which model certain brain functions is to discover the sequence of the human memory

and consciousness.

Let us become familiar with one of the experimental learning machines which has been created in the US and is called "Conflex".

The machine is devised to work on miniature semiconductors; the machine is not large, a total of 0.6 cubic meters. The machine has a control panel and a screen. It contains 48 groups of memory elements, and about 5,000 identifying devices.

The identifying devices in the machine look like the retina of an eye which is made up of individual sensitive elements which are the endings of the ocular mirror. The adding cells of the machine model the properties of the macula lutea of the eye which is the most sensitive portion of the retina where the object being viewed is "generalized" and clearly perceived. But the existing electronic comparison device works analogous to a certain selective filter which is, so to speak, a model of a portion of our brain where the eyes sense the already highly organized signals. As the electronic devices which perceive the images the machine uses 400 miniature photoelements which are as it were the engineering analogies of the human eye. They are connected to the remaining units of the machine similar to the way that the eye is connected to the brain.

The output circuits of the photoelements are connected in a definite sequence with all of the identifying devices. The identifying devices make it possible for the machine to "see", that is, to perceive the surrounding objects which it needs and to "remember" what has been seen. Therefore, the identifying devices are connected to the memory elements of the machine. The total capacity of the machine is about 240,000 electronic elements which form the "memory" for accumulating information.

As a memory device in the "machine memory" they use a magnetic disk and its capacity is 500,000 elementary signals.

Each group of memory elements is connected to its own adding cell where the output signal is produced. These signals are sent to the comparison instrument which strictly determines which of the incoming signals is the greatest and correspondingly fixes it. If the incoming signal causes doubt or if it has come from an object of unknown configuration, the machine gives the signal of calling a human operator.

The machine can recognize 48 different classes of images. It can read 48 letters without a mistake or digits and various signs, and within the limits of each class up to 100 variations of their image. For example, it can recognize a written or a printed letter "A" in 100 different variations.

For remembering each of the 48 image classes, only one given group of all the groups of memory elements is used. This group in projecting the image onto the machine, in imitating "memory" identifies the previously remembered objects, images, etc.

A class of images which is designed for recognition, for example, the letter "A" is viewed by the machine in different variations 5,000 times. And each time the 100 perceiving elements participate in this.

During experiments on sorting correspondence, the machine correctly and rapidly recognized both full and abbreviated names of cities beginning with the same letter. It had even greater accuracy in recognizing human faces.

After showing the machine a photograph, it correctly recognized the faces of persons even in the event that they were partially masked by a screen or strips.

The testing of the machine is continuing. The goal is to achieve precise analysis of all possible reconnaissance air photographs which contain already known configurations of images for military equipment and military installations.

The creation of even more improved learning machines opens up amazing prospects for using them in military affairs. The rapid and precise deciphering of aerophotographs for the foreign military specialists at present is a very important problem. In developing plans for unleashing a thermonuclear war against the nations of the socialist community, the imperialist circles give great significance to espionage, subversive and reconnaissance activity. In preparing for war they give an important role to the strategic aerial photographic reconnaissance. At present the US is carrying on open and secret aerial photographic reconnaissance in the airspace of other states.

In the US it has been computed that they must gather reconnaissance data on the territories of states having an area of more than 41 million square kilometers, and for this they must decipher 180 million photographs. One person studying these photographs with a speed of one photograph (23x23 cm in size) per minute would need more than a thousand years to study them! Even 1,000 decipherers with the modern deciphering methods could not study the photographs in a single year. It is not accidental that the military specialists in the capitalist armies are extremely interested in the learning machines. They promise to be more reliable in deciphering the aerial photographs than the presently available means.

The foreign military specialists assert that machines of the "Conflex" type in the next few years should have a fundamental influence on the development of military equipment.

10,272
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