Intelligent systems: development and issues

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Abstract

Intelligent systems are used to construct an automatic system performing afferent synthesis of objective formulating program of action. Systems of regulatory control and management of various nature objects are also developed and obtained for practical use to get desired useful effect. All these problems offer the challenge of in-depth study in human and animal brain functionality that have to be solved.

Intelligent system, as a last paradigm of artificial, self-registering and adaptable management of various nature objects was firstly defines basing on theory of functional systems (Anokhin P.K.), describing system organization of life form functions that has an objective law of the usefulness of the final effect and the result.

The conception of intelligence system was defined at the end of 90s of XX century. It is a set of technical means combined by informational process and interacting with one person (or group of people) or working independently, that is able to make a decision basing on information, knowledge and incentive to produce an objective and find a rational way to achieve the goal. This definition appeared in 1989.

At this period of time systems of regulatory control and management of various nature objects were developed and obtained practical use. Searching for effective control laws, adaptation to environmental activity, changing of parameters and control system structures were caused by complexity of problem solving, performed by control objects that sometimes exposed to extreme environment influence. Knowledge base appeared as a part control system including experts information, artificial neural networks, realizing education and self-education.

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Systems of automatic control, using mentioned features of their implementation, were called intelligent. But it is far from being a truth!

That’s why it is time to give more detailed explanation of differences between classical automatic control system and intelligence system.

During comparison living organism functions and automatic system operation, problems of objective synthesis, making decision and instructions have a great importance. This problem is called “programming”. It’s important to mention that anthropomorphic expressions like “thinking machine”, “memory” or others are confusing this theme.

The machine program as a part of automatic system performing complicated and long calculations and implemented as physical signals is the best proof of machine mechanical abilities. Such machine has a great speed and number of operation and saves on thousand man-hours.

But it’s principle of operation, no matter how it is complicated, is predetermined by machine construction and human thought.

These features of “programming” are more obvious in human activity. For instance, hammer nails, corkscrew extracts cork, they all depend on program implemented by people and physically realized in appropriate form and construction. The fact that machines in the most complicated constructions turned out to be automatic (self-acting) machines with result of action inverse estimator, i.e. final useful effect, is a result of regular occurrence and all the expedient adaptive human actions in relation to the outside world were developed in accord to it.

Describing general features of automatic system programming we can draw a conclusion that it is a predefined (predictable) and more or less hard way to get desired useful effect. In one case this way can be very difficult and long, in other one – short and simple. If we can find even a remote resemblance of human organism functions?

If we compare actions of human and the most complicated machines, we may notice that human actions can be characterized as actions with “high flexibility, changeability and a sort of arbitrariness”. But it’s not enough. Let’s define some specific traits of human nervous activity organization:

- Each instruction, even for the most complicated automatic system is predetermined before it’s constructed. It can’t be formed in process depending on current environmental conditions. Automatic system can’t take environmental conditions into account and make an instruction.
- Human “programming” of actions is a result of dynamic synthesis of inner and outer factors. The objective and decisions to perform some defined action are being formed only after this afferent synthesis. The number of these syntheses, just as combinations of external condition, is unlimited, that’s why the number of ways to program human actions is unlimited too.
- Human question “What to do?” is a dynamic function that depends on outer and inner current afferences. This question doesn’t exist for an automatic system, it’s actions are predefined and calculated during construction. Or, figuratively speaking, if automatic system had an ability of afferent synthesis and performed it’s actions depending on this synthesis, it will produce shoes in shoe factory department, being constructed to produce cans. If we suppose that one automatic system is able to take part in thousand separate actions in implementation phase, it’s incorrectly to think that the question is in number of combinations. To be more precise, other constructive and resource base is required to perform dynamic and different functions of human organism. Infinite molecular changeability of living matter is required. It means that difference is undoubtedly qualitative.
- These features of human and animal behavior shaping are not exclusive. They all take place currently. Human and animal brain has a great ability to anticipate (to predict) future events and to form behavior based on future events. It’s hard to imagine an automatic system suddenly changing its construction and starts working “precautionary”, as Pavlov I.P. said, in reference to future events.

Physiological features of conditioned reflex as precautionary and signal action consist in the fact that synthetic work of all the afferent parts, especially in the brain frontal part. This synthetic work is certainly completed by forming the behavior in the closest fit to the aggregate of afferent influence on the body. There are no similarities to mechanical associations.

That’s why we have to state two extremely important traits of animal and human behavior modeling that are unlikely to be modeled at the present time.
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