# The use of cognitive mechanisms in computer intellectual systems [1]

Trembach Vasiliy

Ph.D., Associate Professor,
Moscow Aviation Institute (National Research University), «MAI»
tel. 8 910 402 7104,
trembach@yandex.ru

**Abstract.** The report discusses approaches to the creation and development of modern intelligent systems based on cognitive approach. Most of the existing intelligent systems focused on the use of the computer paradigm. The basis of this paradigm laid the symbolic information representation and processing with algorithms focused on the logic and combinatorics, proceedings. This computer approach to solving some intellectual task is inferior to the man. Many experts began to consider new approaches to the solution of intellectual tasks. One such approach is the cognitive approach. Currently, he is associated with the results of many research areas and is difficult to understand and use. The author discusses the main steps of the creation and development of computer cognitive systems for simple model problems. The possibility of applying categories, the role and place of the Gestalt, the formation of characteristic values, which are important elements of cognitive semantics. Emphasizes the need for research in the field of knowledge of cybernetic systems, approaches to their representation, storage and processing, methods of interpreting and creating new knowledge.

**Keywords:** cognitive approach, category, knowledge, intelligent system.

## 1 Current approaches to the creation and development of computer cognitive systems

Developed and applied intelligent systems, for the most part, focused on the application of computer paradigm. This is due to the fact that the emergence and development of computer technology has led to creating on its basis the methods and approaches for solving intellectual tasks. The basis of this computer paradigm includes symbolic representations of reality and their processing with algorithms and procedures that use logics and combinatorics. While solving a lot of such intelligent tasks

---

computer systems are inferior to man. Experts in the field of artificial intelligence consider a number of approaches to solve complex problems for the computer tasks, one of which is the cognitive approach.

The basis of the cognitive approach focuses on the processes that are associated with the representation, storage, processing, interpretation, and the creation of new knowledge. For computer cognitive systems the important issues comprises the application of mechanisms common for developed biological systems headed by a man, and which are required for the solution of intellectual tasks.

Now many experts investigate the approaches connected with construction and development of computer cognitive systems. These approaches focus on the basic elements of cognitive science: concepts, prototypes, categories, Gestalt. Studying, application and development of the systems with these elements demands the methods taking into account cognitive aspects in processes of perception, thinking, knowledge, explanation and understanding. The article [1] states that "… research problems and application of cognitive mechanisms of a modern human are very complicated. It can be connected with the influence of many factors of evolutionary development on them. The example of such factors can be the following [2,3]: experience of interaction with the outside world; education; education level; culture; religion; individual dogmas; delusions; hopes, etc..."

It is considered that it is vital to start the research on these issues as it is noted in the work [4], "… from a simpler intellectual living system. They have no accumulated factors of evolutionary development, i.e. education, culture, religion, nurturing. But at the same time any animal of Crustaceon level and above this level can act in different situations more effectively than any artificial systems of purposeful behavior … "

## 2      Structure of cognitive system for simple model tasks

One of a simpler model task can be a subject of the applied approaches to investigate cognitive computer systems focused on the solution of complex challenges.

The use of a simple model task is necessary to understand, to research, to create and to develop cognitive computer systems. The understanding of a system operation during the decision of a simple task is the result of studying and reconstructions of cognitive mechanisms used by a human while deciding such a task. Research is necessary for studying new structures of systems, their behavior and their development.

As a simple model task we can consider the situation in which it is necessary for the object with a cognitive computer system to find a subject from any point of the stated location, to reach it and to perform some operations.
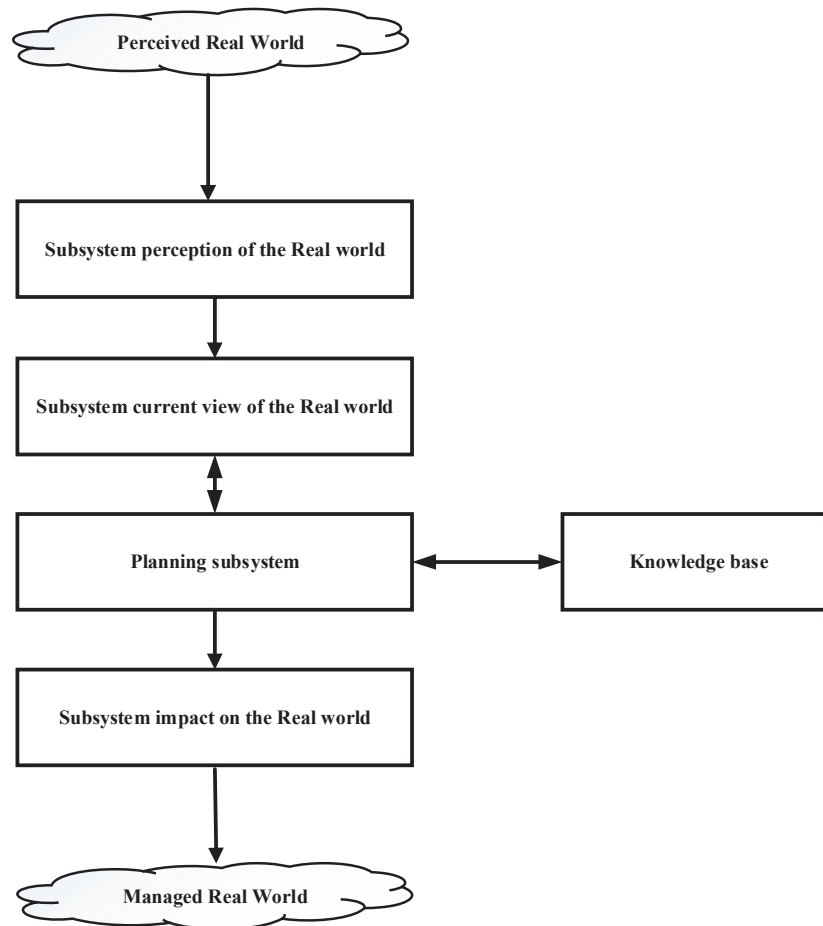
**Fig. 1.** The structure of cognitive computer systems to simple model problems.

The structure of a cognitive computer system for the solution of the stated model task is shown in the figure 1. The system contains:

- subsystem of Real world perception;
- subsystem of a current Real world concept;
- planning subsystem;
- knowledge base;
- subsystem of Real world impact.

The subsystem of the Real world perception represents a set of sensors measuring parameters of the surrounding world.

The subsystem of a current Real world concept collects the results of all measurements, transforms them to a format, universal for the system, and at the request of a planning subsystem represents the current values of corresponding signs (parameters). It represents a prototype of telemetric system.

The planning subsystem forms a great number of managing influence impacts to transform the object from a current to a demanded state . Integrated approach to represent knowledge is used.

The knowledge base contains knowledge necessary for planning managing influence impacts.

The subsystem of impacts on the Real world carries out the realization of the managing impacts (commands) of an object of the Real world.

## 3      The creation of computer systems with the use of cognitive mechanisms

The main approaches to the creation of computer systems using cognitive mechanisms to solve simple model problems are the following::

1. A system based on knowledge of the classical type. It is assumed that you are using the ideas about the objects of reality as concepts generated by the subsystem of perception of the Real world. Subsystem perceives reality through a sensual image. These concepts are presented in the format of an integrated approach to knowledge representation.
2. Creating and using object subsystem of formation and application of concepts. The concept of the authors Z. D. Popova and I. A. Sternina refers to: "...discrete mental education, as the basic unit of mental human code possessing a relatively orderly internal structure, which is a result of cognitive (cognitive) activities of the individual...". In computer cognitive system, mental concepts are represented by units in structure using both real and mental nature. Mental entities are generated based on the single units, and then by general (abstract) concepts of the real world. In the development of cognitive systems at first single units, and then abstract (generic) mental concepts and signs can be applied.
3. Creating and using object subsystem of formation and application of categories. In computer systems, cognitive categories are initially formed with the participation of a human. On the basis of machine learning, for example, deep learning of neural networks a model mechanism for the creation of categories is formed based on the experience of the inner world of a person (team of specialists). After you have successfully created a model of the mechanism of the formation of the categories it replicated for future application without human intervention.
4. Creating and using for the object the subsystem of formation and application of new concepts based on the measuring characteristics (parameters), concepts and categories. This subsystem must ensure the development (evolution) of computer cognitive systems.

# 4    Conclusion

The proposed cognitive mechanisms can serve as the basis for building new applications. The provisions of this approach can be supplemented and changed depending on the tasks assigned. In the author's opinion, the use of prototypes at one of the stages of creating computer cognitive systems is promising.

# References

1.  Trembach V.M., Kognitivnyj podhod k sozdaniyu intellektual'nyh modulej organizacionno-tekhnicheskih sistem. // Nauchno-prakticheskij zhurnal «Otkrytoe obrazovanie», №2, 2017, s. 78-87
2.  Lapaeva L.G., Bychenkov O.A., Rogatkin D.A. Nejrobiologiya, ponyatijnye kategorii yazyka i ehlementarnaya model' mira robota// V kn. Pyatnadcataya nacional'naya konferenciya po iskusstvennomu intellektu s mezhdunarodnym uchastiem KII 2016 (3-7 oktyabrya 2016g., g. Smolensk, Rossiya): Trudy konferencii. T.2. -Smolensk: Universum, 2016. - s. 292-300.
3.  CHudova N.V. Konceptual'noe opisanie kartiny mira v zadachah modelirovaniya povedeniya // Iskusstvennyj intellekt i prinyatie reshenij. 2012. №2.
4.  Rogatkin D.A., Kulikov D.A., Ivlieva A.L. Tri vzglyada na sovremennye dannye nejronauk v interesah intellektual'noj robototekhniki // Modelingof Artificial Intelligence, 2015. Vol. 6, Iss. 2.