#91

BICA*AI 2023

Dynamic Model of Semantic Information Signal Processing

Mohiniso Hidirova[1], Kamaliddin Abdivakhidov[1], Pavel Bylevsky[2], Alexey Osipov[3], Ekaterina Pleshakova[3,4], Victor Radygin[4], Dmitry Kupriyanov[4], Mikhail Ivanov[5]

[1]Yeoju Technical Institute in Tashkent, 156 Usman Nasyr Str, Tashkent, Uzbekistan, [2]Moscow State Linguistic University, Petroverigsky lane, 6/8, Moscow, Russian Federation
[3]Moscow Technical University of Communications and Informatics, st. People's Militia, 32, Moscow, Russian Federation, [4]National Research Nuclear University "MEPHI", 31 Kashirskoe Shosse, Moscow, 115409, Russian Federation, 5Financial University under the Government of the Russian Federation, Shcherbakovskaya, 38, Moscow, Russian Federation

SUMMARY

The article deals with the mathematical modeling of the regularism of thought processes based on the concept of ORASTA, consisting of a controller operator (OR), capable of receiving, processing and transmitting signals of semantic information that changes the oscillatory background in a person's mind, and an active contextual environment of regulation with a temporary constant, allowing to carry out a feedback loop in the system in a finite time. equilibrium positions at certain ranges of parameters is revealed; the existence of stable and complex oscillatory modes of operation, which are important for analyzing the nature of the occurrence, development and deformation of the oscillatory background during the implementation of information processes in the activity of systems capable of thinking independently in the case of various external and internal signals. The developed equations of the regulatory mechanisms of paired associative phenomena in consciousness, taking into account the coupling of cognitive self-organizing processes, can be used for safe communication methods.

INTRODUCTION

With the help of continuous wavelet study, methods of analysis and diagnostics of oscillatory neural network activity of the brain according to experimental electroen-cephalograms, researchers identify such oscillatory patterns as sleepy spindles, bursts of t etaactivity, K-complexes, peak wave discharges (PVR), characteristic precursors of epileptic discharges

APPROACH

B.N. Khidirov developed methods of quantitative research of complex oscillatory regulatory systems, which allow considering a wide range of phenomena united by the presence of a regulatory system, regulatory environment, competition, cooperation and combined feedback from a single position. The concept of ORASTA was introduced, consisting of an oscillator regulator (OR) capable of receiving, processing, and transmitting signals of a certain nature, and an active medium with a time constant (active system with time average – ASTA), which allows for a feedback loop in the system for a finite time. One of the main ideas in the mathematical modeling of the regulatory mechanisms of consciousness is the central regulation of information flow based on multi-oscillatory ORASTA.

METHODS

We will consider the associative regulatory mechanisms of the thought process, which are based on short-term regulatory connections. Considering that the appearance of some mental phenomenon in a person's consciousness leads to the emergence of another state, we can propose the system of functional differential equations.

RESULTS

It should be noted some evolutionary aspects of the development of consciousness. Since associative regulatory systems of consciousness can have mild excitations of activity from a state of rest with the slightest changes in mc, it is evolutionarily more likely that associative systems of consciousness will first appear, initially it may even be in the form of simple self-oscillating systems in a separate elementary conscious-ness. Further development of consciousness with the accumulation of sufficient re-sources could create favorable conditions for the emergence of interconnected systems capable of evolutionary development. Unlike associative systems, the competition of interconnected systems for resource supply can lead to the elimination of relatively "weak" systems and the survival of more progressive systems with a sufficiently large mental resource supply. The latter have specific features of development and opportunities for progressive evolution. Thus, for modeling the regulatory mechanisms of thinking processes, the most justified and relevant is the construction of systems of functional differential equations with de-lay, since they allow taking into account time relationships in the regulatory system. The developed equations of the regulatory mechanisms of paired associative phenomena in consciousness, taking into account the coupling of cognitive self-organizing processes, can be used to build chaotic artificial neural networks with a complex activation function with self-learning and generalization.

ANALYSIS

Computer studies allow us to quickly assess the general regularity, characteristic features and basic modes of decision behavior. They make it possible to obtain approximate solutions of nonlinear functional differential equations because of the regularity of thinking, to evaluate the behavior of irregular solutions and the level of their "randomness", to analyze the regularity of the processes of extracting meaning from the information flow through "computational experiments". The developed GIR software tool allows changing parameter values, detailing and temporary stopping for archiving visual material.

DISCUSSION

The results of the analysis of the nature of solution (2) show the possibility of the existence of zero and positive equilibrium positions, stable periodicity – self-oscillations, irregular oscillations – dynamic chaos. These properties of solutions, which are necessary conditions for the application of differential equations for the quantitative description of the regulatory mechanisms of consciousness, are due to the nonnegativity and the limited number of PRODUCTS, the presence of rest states and the existence of a functionally active phase of the regulation of brain signals. One of the main factors in determining the true meaning of information is the context, that is, the regulatory environment of ASTA.

CONCLUSIONS

The created neural network needs not to be trained, but to be formed, that is, to form the skill of hierarchically operating with images and concepts with central regulation of information flow based on multi-oscillatory ORASTA. Moreover, the regulatory approach can be useful for the development of cryptographic algorithms for transmitting information in a variety of contexts. The areas of the same type of behavior of various dynamic modes of bifurcation transitions depend on the main parameters of the system and the patterns of functioning of external and internal influences. The results allow us to quantify the parameter ranges necessary for an adequate comparison with experimental data.