Galina A. Samigulina

IMMUNE NETWORK MODELING TECHNOLOGY FOR COMPLEX OBJECTS INTELLECTUAL CONTROL AND FORECASTING SYSTEM

Monograph

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The monograph is devoted to the development of technology of immune-networks modeling for processing of multidimensional data on the basis of the perspective biological approach of Artificial Immune Systems (AIS) and construction of intellectual control and forecasting system for different applications. Realization of intellectual component-based software is described for control of the complex objects on the basis of approaches of artificial intelligence.

The book is intended for students and experts in the field of the newest information technology, the automated systems of processing of the information, control of complex systems and artificial intelligence.
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INTRODUCTION

The researches in the field of an Artificial Intellect (AI) are carried out during last fifty years. The key task of AI is the problem of simulation of biological principles of the data processing. At present in the given direction most developed are: cellular automaton, genetic algorithms, artificial neural networks and artificial immune systems. First of all, capacity of the natural biological systems to decide multidimensional problems of huge computing complexity in the real time is attracted.

The Artificial Immune Systems (AIS) is especial interesting. The peptide (protein) is the basic element. The biological prototype is the immune system of the man and data processing by molecules of the protein on the basis of the result of self-assembly. The Artificial Immune Networks are the adaptive systems for processing and data analysis, which one represent mathematical patterns simulating some functions of the immune system of the man and possessing properties, such as learning capability, to forecasting on the basis already of available time series and decision marking in the unfamiliar situation. In principle AIS do not require beforehand known model, and its make on the basis of the obtained information as time series. In the fundamentals of the approach AIS is the idea of interaction between proteins of the immune system of the man and stranger antigens, that is in the capability of arbitrary linkage (molecular recognition), by means of definition of minimum energy linkage between the formal peptides at the solution of the problem of pattern recognition.

The Artificial Immune Systems are applied at the solution of the problems with badly algorithms, such as prediction, classification and control.

The first section is dedicated to modern problems and review of reference directions AI base on simulation of the natural phenomena. The definitions of the main concepts AIS are given. The indispensable items of the information from the microbiology, biophysics, and biochemistry on the main problems of an immunology, constitution the proteins and conformation analysis of biopolymers is adduced. Designed intellectual know-how of the analysis and data processing by immune networks explicitly is described. The problems of prior data processing are esteemed at creation effective AIS, obtaining of optimal
pattern of the immune network on weighting coefficients of informative characteristic, solution of the problem of pattern recognition, estimation of the power errors. The procedure of calculation of factors of risk of forecasting AIS is described.

In the second section the fundamental theory for creation of information expert systems of the forecasting and control of composite non-linear objects in conditions of prior equivocations of the stochastic type on the basis AIS in the real-time are designed. The basic difficulties are reviewed at creation of these systems and the solution of these problems. This section is devoted to Industrial realization immune-networks technology on the modern equipment Shneider Electric and Siemens. In the next section of the intelligent component-oriented software for control complex objects on the basis of artificial intelligence approaches is designed.

The fourth and next sections are devoted to the computational molecular design of drugs based on immune network modeling. While designing new drugs the particular importance has the problem decision of the installation the relationship between the structure and the properties which are considered as candidates for chemical compounds. The intellectual technology, algorithms, software for computational molecular design of new drugs based on biological approach of artificial immune systems was developed.

At the end of the monograph there are a references and a glossary.

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The text of the monograph was written in Russian.
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Galina Ahmetovna Samigulina

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