Chapter 29
The Concept of Teaching Course on Intelligent Information Systems

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ABSTRACT

This chapter proposes the concept of hybrid intelligent information system (HIIS) as a "glue" concept that helps to unite disparate sections of a course on intelligent information systems. The chapter discusses a generalized structure of HIIS based on modules of consciousness and subconsciousness. The authors show that a HIIS may be implemented using a multiagent approach based on holonic organization. They provide a formalized model of metagraph and a review of methods to describe holonic agents based on the metagraph approach. Thus, a HIIS allows one to combine different approaches which are taught in a course on intelligent information systems.

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INTRODUCTION

The classical course on intelligent information systems traditionally may include the following topics:

- Expert systems (e.g., CLIPS) and other rule-based programming systems, based on forward chaining approach (e.g., Drools).
- Logical programming languages (e.g., Prolog).
- Models of knowledge representation, ontologies, and ontologies reasoning.
- Neural networks, soft computing, fuzzy methods, and machine learning.
- Evolutionary methods (i.e., genetic algorithms, genetic programming).
- Multiagent systems.
- Decision support systems.

The problem is that these topics are heterogeneous and perceived by students as a mosaic of disparate pieces. In order to address this issue, a "glue" concept is necessary to unite the disparate pieces of the mosaic. Thus, the authors propose a hybrid intelligent information system (HIIS) based on the multiagent approach as such a concept.

Currently, it is possible to note a clear trend towards the joint use of different intelligent methods to solve various classes of problems. It has led to the emergence of such scientific area as "hybrid intellectual systems" (HIS). As fundamental research in the field of HIS, it is possible to consider Professor Kolesnikov and his colleagues' (Kirikov, Kolesnikov, Listopad, & Rumovskaya, 2015; 2016; Kirikov, Kolesnikov, Listopad, & Soldatov, 2015) works.

Nowadays, as a rule, intelligent systems are not developed separately; rather, they are embedded as modules in a traditional information system to solve tasks related to the intelligent processing of data and knowledge. In this work, this combined system is referred to as a HIIS.

A HIIS has the following features:

- It combines various methods to build intelligent systems, and, in this sense, may be represented as a HIS.
- It combines intelligent techniques with conventional methods for processing data in information systems, and, in this sense, may be represented as a combination of HIS and a conventional information system.

The key issue is how to implement the principle of hybridity. In this regard, the authors started their research from Professor Yarushkina and her colleagues' (Perfilieva, Yarushkina, Afanasieva, & Romanov, 2016; Yarushkina, 2004; Yarushkina, Moshkin, Andreev, Klein, & Beksaeva, 2016) outcomes. Yarushkina (2004) formulated the principle of hybridity as follows:

The literature provides schemes of hybridization of neuroinformatics and AI, which are built on the following principle: The right hemisphere is the neurocomputer; the left hemisphere is a knowledge-based system and the only question in their interaction or balance of right and left hemispheres. In real human behavior, perception and logic processing cannot be separated. Therefore, the scheme of deep integration is more successful. (Yarushkina, 2004, pp. 17-18)