Digital Intelligent Design of Avatar-Based Control With Application to Human Capital Management

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ABSTRACT

The article is devoted to modern digital technologies of management. A new approach to construct digital avatars has been proposed. It combines knowledge-based self-learning mechanisms and switching decision-making properties, based on using differential equations with special structure. As a main field of methodology's application, the field of human capital management has been considered. It is shown that the approach can essentially increase efficiency of HR activity. Some problems of using the method have been mentioned also. The article has mainly theoretical character, although practical aspects of the problem has been discussed.

KEYWORDS

Artificial and Natural Intelligence, Big Data, Cyber-Social Management, Differential Equation, Digital Intelligent Avatar Technology, Human Capital Management, Internal Bifurcation, Volterra's Model

INTRODUCTION

The power of avatar-based technologies in many applied fields, such as digital management systems, knowledge bases, big data, decision making systems and so on, is well known. The team from Australia, Armenia, Russia and Ukraine, the authors belong to (Mkrttchian et al., 2019), proposed a set of approaches to development of avatar-based management using blockchain technology for implementation of economic solutions on different levels. It is a way to identify a avatar-based model as a tool for policy advice. An empirical basis was collected mainly during realization of the recently completed project "Triple H Avatar an Avatar-based Software Platform for HHH University, Sydney, Australia which was carried out 2008-2018" (Mkrttchian, Bershadsky, Bozhday, Kataev & Kataev, 2016). Elaborated models were based on avatars and unified macro and micro levels of the simulating process. It was an attempt to propose a single platform for solving problems in various areas of the digital economic system. Possibility to scale simulations for a set of economy-involved avatars and to provide graphical user interfaces allows to the digital system to serve researchers, who are not familiar with the technical details of the model realization. It allows also designing special parts of used model for numerical experiments and analysis of modeling results.

In the same time, an optimal internal structure of the used avatars is the open problem. It is clear, that, additionally to ability of synchronization with external actors, the avatars should have individual characteristics of behavior, including mechanisms of learning (with corresponding learning curve (Acorn, 1985; Chernousenko, Chernenko, Chernyshenko, 1988) and artificial intelligence. Special algorithms of transmission of inputs to outputs have to be proposed. One of possible ways is to use, for determination of these algorithms, a number of well known models of the decision making process, based on classical differential equations. It can be models with linear transmission functions, or quadratic ones, like Lotka-Volterra models. A weak point of such approach is a pure continuous character of behaviour of such avatars; particularly, they reactions for small impacts will be also small. It is not a good property for the avatars; they should have in many cases "information reaction", when small, but special impact can produce very intensive reaction of an avatar.

The article is devoted to consideration of mathematical aspects of constructing avatars with logic of behavior, based on differential equations, but, in the same time, demonstrating pseudo-discrete properties (Chernyshenko, 1997). A main used concept is "internal bifurcation" (Chernyshenko, 2005), a tool, which generalizes ideas of the catastrophe theory from models' external properties to internal ones. As an example, a system of two interacting avatars can be considered.

A way to use of the approach in the field of human capital management is considered. A promising task is the formation of universal mechanisms for the digital transformation of universities (Chernyshenko, Piven, 2016), scientific organizations, enterprises of the real sector of the economy to ensure the necessary and sufficient efficiency of integration and cooperation mechanisms within the framework of world-class scientific and educational centers, to form new training tools for the digital economy. All this will require the development of the human potential of key project implementers. The style of organizing the activities of enterprises and organizations makes it absolutely necessary to study the fundamental problems of applying decision support and Knowledge Management Technologies (KMT) in socio-economic systems.

By applying Avatar-Based Management functions (the approach will be characterized below), more information will be generated. This information allows businesses to conduct analyses, and to carry out new queries and assessments on particular problems (Gürder & Yılmaz, 2013). Non-spatial (attribute) data define geographical areas or describe the properties of spatial entities. The salary and/or age, for example, of a shopper living at a particular address, are attribute data. The address remains a geographical data. A spatial database warrants that geographical data and attribute data are connected to each other. Thus, spatial-based information systems will contribute to operational knowledge management activities (Gürder & Yılmaz, 2013). The key factor in Avatar-Based Management success, just like many other technological innovations, is how practical it is in solving the organization's problems.

The constructing digital avatars with differential logic, oriented for realization of KM principles in the field of human capital management, can essentially stimulate progress in this field. The objective of this article is to propose and discuss the main perspective ways of such constructing. Practical realization of the approach and its use in special real cases will be a matter of further research of the authors.

BACKGROUND

There are not many works devoted to studying the impact of the introduction of digital technologies on the formation and quality of human capital, as well as methods for managing them, which are mainly descriptive in nature without formalizing the parameters of the management process and identifying significant factors (Bondarouk, Parry, & Furtmueller, 2017; Jesuthasan, 2017; Larkin, 2017; Mekshun, 2018; Obeidat, 2015). Authors, as a rule, do not claim to build adequate formal models of the process; and in no way go deeper into the informational nature of the new digital environment in which employees of modern enterprises and organizations involved in the decision-

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