Probabilistic dynamic logic of cognition

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Abstract
We developed an original approach to cognition, based on the previously developed theory of neural modeling fields and dynamic logic. This approach is based on the detailed analysis and solution of the problems of artificial intelligence – combinatorial complexity and logic and probability synthesis. In this paper we interpret the theory of neural modeling fields and dynamic logic in terms of logic and probability, and obtain a Probabilistic Dynamic Logic of Cognition (PDLC). We interpret the PDLC at the neural level. As application we considered the task of the expert decision-making model approximation for the breast cancer diagnosis. First we extracted this model from the expert, using original procedure, based on monotone Boolean functions. Then we applied PDLC for learning this model from data. Because of this model may be interpreted at the neural level, it may be considered as a result of the expert brain learning. In the last section we demonstrate, that the model extracted from the expert and the model obtained by the expert learning are in good correspondence. This demonstrate that PDLC may be considered as a model of learning cognitive process.

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1. Introduction
Previously, an original approach was developed to the cognition simulation based on the theory of neural modeling fields and dynamic logic (Kovalerchuk & Perlovsky, 2008; Perlovsky, 1998; Perlovsky, 2006; Perlovsky, 2007). On the one hand, this approach is based on the detailed analysis of the cognition problem for artificial intelligence — combinatorial complexity and logic and probability synthesis. On the other hand, it is based on the psychological, philosophical or cognitive science data for the basic mechanisms of cognition. The main idea behind success of NMF is matching the levels of uncertainty of the problem/model and the levels of uncertainty of the evaluation criterion used to identify the model. When a model becomes more certain then...