Decision Making and Control of a Cognitive Agent's Knowledge Process Under Time Constraints

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Abstract: Considered are the questions of designing a system for modeling the reasoning of a cognitive agent, capable of making conclusions based on its knowledge and observations of the external environment, solving problems in a hard enough real-time mode. To work in this mode, the existence of a critical time threshold is established, which is set to solve the problem facing the agent. Exceeding the threshold is fraught with grave, sometimes catastrophic

consequences and for the agent is unacceptable. The formal basis of the modeling system (cognitive process control) is a logical system - extended step theory, that combines the concepts of active temporal logic and logical programming. Among the original methods proposed by the authors in the work, an approach to combining the concepts of active logic and logical programming in one logical system should be noted; an approach to constructing a consistent declarative semantics for extended step theory of active logic; a method of formalizing temporal, nonmonotonic reasoning of an agent using extended step theory of active temporal logic; a method of granulating time in a logical system to formalize meta-reasoning. A subclass of temporal logic is considered, oriented to application in real-time systems. Additionally, the issues of managing the agent's cognitive process in hard real-time, eliminating anomalies (unforeseen situations), and applying the temporal logic of branching time are investigated in more detail.

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