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# Application to the AI of the belief revision based on the dynamic epistemic logic

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In late years, a field of artificial intelligence develops exceedingly. The artificial intelligence is a machine with the human intelligence, and the research field is large, and a study is carried out from various aspects by genetic algorithm, sound recognition, image recognition, sensitivity processing, machine learning, natural language processing, logic and so on. It comes into practical use widely in everyday life. In addition, if we analyze the human brain and can produce the artificial intelligence which can consider precisely, artificial intelligence is expected to develop smarter in the not-so-distant future. It becomes necessary to formalize the process that a human being thinking about things to create the artificial intelligence. In a logical field, logic to handle human knowledge is prosperous, and one of them is the dynamic epistemic logic.

The dynamic epistemic logic in mathematical logic has been studied independently to application to the field of the artificial intelligence by a logician towards a problem how we can change knowledge and belief when a human being gets new information. The belief refers to the contents which an uncertain person believes, and it includes misunderstanding. On the other hand, knowledge is an objective fact. The belief enables a change in truth value only in the world of the recognition. The method in belief change includes expansion, revision, and contraction. When information was given for a certain belief, as for the expansion, the belief set became the sum of sets with belief and the information. With the revision, instead of receiving new information, we can delete part of the proposition in the belief and maintain consistency. With the contraction, I delete the proposition in the belief without adding new information and maintain consistency. The belief change is intended to observe a dynamic change of belief while keeping consistency by using these methods.

Therefore a purpose of this study is to apply the dynamic epistemic logic closed in basic mathematical interest so far to a problem of the real artificial intelligence. For this reason, it is necessary to simulate and verify the reduction process of the possible worlds in the detective story and the logic puzzle by implementing a computing system updating knowledge and belief using the dynamic epistemic logic. When we are going to realize the inference process on a computer, we require two parts: one is a system to infer, the other is a knowledge base to maintain necessary information to infer. The knowledge base includes the supposedly true information, together with their justification. The update of knowledge and belief is not a simple accumulation of the information. It is intended that we simulate the change of a belief state, in accordance with the acquisition of new information by the deletion of the possible choices.

There is an example of the logic puzzle called sum and product. As for this, information is updated by the conversation between agents, and accessibility relation is gradually deleted. An announcement may be considered to include little information, but it removes, in fact, a large quantity of accessibility relation. This issue can model the process when belief is updated by a conversation. The detective story has a similar situation. The reader can obtain information by the material for reasoning with the progress of the story. It means that the inference of the reader builds a logical structure for the causation and time order in a sentence.

We can grasp the inference in the detective story as the process that knowledge and belief are updated in accordance with the progress of the story, where we can restrict the choices in *inquisitive semantics*. We extend the logic with a new relation ' $\sim$ ', and verify the reduction process of possible worlds, by computer simulation.