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Abstract

In this thesis, our aim is to employ the many-valued logic to the multi-agent system. First, we extend the semantics of epistemic logic to a many-valued one. Second, we introduce many-valued semantics to express the epistemic states instead of Kripke semantics. To obtain such bases, we focus on the following issues in this thesis.

The first issue is to employ a 4-valued epistemic logic to distinguish the public/private information passing in the multi-agent system. Thus far, the agent communication has often been modeled in dynamic epistemic logic, where each agent changes his/her belief, restricting the accessibility to possible worlds in Kripke semantics. On some occasions, the recipient changes he/she belief since he/ she may not have enough background knowledge to understand it or the information may be encrypted and he/ she may not know how to decipher it. Here, we generalize those messages as private information. For this purpose, we employ 4-valued logic where each proposition is given 2 (true and false) times 2 (private or public) truth values.

The second issue is to build a n-topic semantics for the infectious logic. Beall advanced a new and interesting interpretation of Weak Kleene logic, in terms of on-topic/off-topic. In brief, Beall suggests to read the third value as *off-topic*, whereas the two classical values are read as *true and on-topic* and *false and on-topic*. Building on Beall's new interpretation, we offer an alternative semantic framework that reflects our motivations, then we provide a new interpretation of the logic of Castuskoti. Finally, we offer a general result that will allow us to make sense of a family of infectious logics in terms of Beall's on-topic/off-topic reading.

The third issue is to provide many-valued semantics instead of Kripke semantics to show the epistemic states of agents. Employing epistemic logic to express the epistemic states is often too complicated to build because we should consider all possibilities of the knowledge between agents. Here, we employ a many-valued logic to express the epistemic states of agents. We consider that there exist three kinds of epistemic states of *known, truth-value unknown*, and *content unknown*. And furthermore, we introduce two kinds of agent communication in our semantics, i.e., teaching and asking, and show how the epistemic states of agents will change.

Keywords: Epistemic logic; Many-valued logic; Multi-agent system; Infectious logic; On-topic/off-topic; Agent communication