A Logic of Belief with the Complexity Measure

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In order to model agents as resource-bounded, the current work measures *complexity* of a reasoning process and makes *simple conclusions* of agents' beliefs more accessible for the agents than *complex* ones. This is done by an *abstract complexity measure* (ACM) function c that maps a sentence α and a set of sentences X to a partially ordered set R. Intuitively, $c(\alpha \,|\, X)$ denotes the complexity or resources needed for inferring α from X.

A belief state of an agent with $r \in R$ resource is modeled as an *r-belief state* $\mathcal{B}^r = \{i^r, s^r\}$, where i^r is an *initial belief set* – beliefs that are initially actively hold by the agent, and $s^r = \{\alpha \mid c(\alpha \,|\, i^r) \leq r\}$ is a *potential belief set* – beliefs for which an agent has a resource to infer them from his initial beliefs. In the logic of belief with complexity (LBC), the k^{th} agent initially (potentially) believing α is written as $\mathbf{I}_k\alpha$ ($\mathbf{P}_k\alpha$) and means that $\alpha \in i^{r_k}$ ($\alpha \in s^{r_k}$).

In order to flesh out an ACM, it is sufficient to define a concrete complexity measure (CCM) in terms of complexity of proofs of one's favorite proof system. While doing so a CCM is defined in terms of numeric costs of tableaux of a tableau method. To calculate a cost of a tableau, a cognitively relevant *cost assignment* is assumed for entries of tableau rules. Furthermore, it is shown that a resulted tableau belief logic (TABL) – an instance of LBC – has a sound and complete tableau proof system.