Perseus - a tool for automatic verification of persuasion

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The general motivation of our research is to provide the tool, called Perseus, which enables the formal verification of the persuasion process [3]. In particular, we are interested in studying those properties of persuasion which are typically not considered in formal approaches, but which are very important from the perspective of the real-life practice. At this stage of our research we include in our model the aspects related to the fact that some arguments have stronger impact on beliefs than the other ones. Therefore, we want Perseus to investigate strength, dynamics and subjectivity of persuasion. It enables to study the *degree of changes* in agent's beliefs and to *track those changes* step-by-step, i.e. at any intermediate stage of the persuasion (after the first argument, after the second and so on). Moreover, Perseus allows to take into account the *subjective aspects* of persuasion. It shows what impact the proponent and audience have on a persuasion process and its effects.

Our tool is based on $\mathcal{AG}_n$ logic [1], which allows for expressing both uncertainty of an agent about a given claim and change of this uncertainty caused by specific actions. In order to reason about uncertainty we use two different uncertainty operators. A formula $M!_i^{d_1,d_2}\alpha$ says that an agent i considers d_2 doxastic alternatives (i.e. visions of a current global state) and d_1 of them satisfy the condition α. Intuitively it means that the agent i believes with degree $\frac{d_1}{d_2}$ that α holds. A formula $\mathbf{P}_i(\alpha) = q$ says that i believes α with the probability q. Both of those operators encode different and complementary properties of a persuasive system. For reasoning about the change of uncertainty caused by a certain persuasion, a formula $\Diamond(i : P)\alpha$ is used. It says that after performing a sequence of persuasion actions P by agent i the condition α may hold. For more details see [1, 2].

Perseus offers two main options of investigation. First, it can semantically *verify satisfaction of formulas* of the $\mathcal{AG}_n$ language which describe properties under consideration in a given model. Second, it can *search for answers to questions* of three kinds - questions about the degrees of uncertainty, questions about the sequence of arguments that should be executed and questions about the agents participating in persuasion. The system input data, i.e. input question, is compounded with three parts. The first one is a specification of a model of a multi-agent system. The second one is an arbitrary state of a model of the system. The last one is an expression, which represents this system a property. Next, the Perseus system executes a parametric verification of the input question, i.e. tests if and when the property is true. The output data is the answer to the question, which can be either *true* or $false$. If a positive answer is given, then a solution, i.e. criteria when an expression is true, are presented. Example questions are "What will a degree (probability) of an agent's belief in some claim be after a specific persuasion is performed?", "Which persuasion should be executed to change a degree (probability) of an agent's belief in some claim to a specified level?". To the best of our knowledge, there is no other tool that allows to verify the formulas with the modalities expressing updates of probabilistic beliefs induced by persuasion.

References

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