Building user argumentative models

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Abstract Knowing how a user builds his/her arguments during a discussion gives useful advantages if we want to assist the user or analyse his/her argumentative skills. This paper presents a novel mechanism to build user argumentative models, which captures the argumentative style to generate arguments. To this end, we observe how users generate arguments, and apply a generalised association rules algorithm to discover rules for argument generation. These rules depict the argumentative style of the user. They are composed of an antecedent, which represents the conditions to build an argument, and a consequent, which represents such argument. To evaluate this proposal, we show results obtained in the domain of meeting scheduling. We discovered interesting rules from a group of users discussing in that domain, and checked that about 60% of the arguments that users had generated in a test situation can be also generated from the rules previously learnt, at least partially. Finally, although this work focuses on modelling users’ argumentative style, we discuss how this promising approach could be applied in different knowledge domains.

Keywords User modelling · Argumentation · Generalised association rules

1 Introduction

During a discussion, in collaborative and cooperative environments as well as in competitive ones, users exchange proposals and arguments in order to reach agreements. Proposals are motivated by their goals, and arguments are pieces of information that are generated by the user to justify such proposals or try to influence the position of the opponent during the discussion in order to persuade him/her to accept or resign a proposal. In this context, the ability to generate “good” arguments is crucial to influence the final result of the discussion. Nevertheless, all users do not have the same argumentative abilities. Therefore, if we know these user abilities we will use that information to take decisions or assist the user in a personalised way. For example, decide how tasks that demand argumentation must be allocated between users belonging to an organization, as part of the modelling of behaviour in it [1–3]; or to assist users by suggesting arguments during a discussion.

For instance, if two users A and B must agree on the time of a meeting, it will be normal to think that the agreement will not be easily reached, because the preferences about time are not the same for both users (e.g. a user A may prefer meeting in the morning, but B in the afternoon). Hence, user A can try to persuade B to accept a morning meeting saying that B has scheduled several meetings in the morning in the past, instead B can try to persuade A to reject a morning meeting because the lab is occupied (supposing that the lab is the place where A wants them to meet). Both arguments accomplish the same goal: persuading the
opponent to accept his/her proposal, but are built in different ways. User A makes use of historical information about B to build a counter-argument while user B employs current information to indicate that A’s proposal is unviable. Thus, we can preliminarily observe two different argumentative styles: one which uses historical information to attack the opponent’s refusal, and another one that uses current information to refuse the opponent’s proposal.

Each user has a personalised style to argue. This style characterises how the user builds arguments, in what situations he/she uses a given kind of argument and when not, and what factors of the context have an influence on these decisions. We call this style, argumentative style. For this reason, A and B build similar arguments, but with different information to support them and taking into account diverse factors to generate them.

In fact, users take into account the contextual information of the discussion (such as past proposals, current goals, preferences between goals and beliefs about the domain and users) to generate his/her arguments. To defend or defeat a proposal, the user evaluates the context of the discussion and determines which argument can be generated to support or refuse it. Particularly, the user must find in that context the information that satisfies the conditions under which an argument can be generated (e.g. in the previous example, A must find evidence about past morning meetings of B). These conditions implicitly form rules for argument generation. So, if the condition is satisfied in the discussion context, the argument can be built. We argue that the argumentative style of a user is exhibited by the tacit set of rules that he/she uses to generate arguments.

Therefore, to capture the argumentative style of a user, we can learn the rules for argument generation and build a user argumentative model with these, without the necessity of having a taxonomy or typology of argumentative styles.

These rules are implicitly used by the user in the discussion; whereby we will not be able to access to them directly. However, we can observe the participation of the user in the discussion, learn how the user performs the argument generation and discover the rules that depict his/her argumentative style.

In this work, we present a mechanism to build a user argumentative model, which captures the argumentative style of a user, learning the rules for argument generation that the user implicitly exhibits during the discussions. To carry out this idea, we first observe how the user builds his/her arguments during discussions, and store each argument generated and the information that the user determined as condition to build them in a knowledge base of observations. After that, we transform these observations, which are tuples of conditions and arguments, in transactions to be processed by a generalised association rule algorithm [4]. We propose to use this kind of algorithm because it allows us to obtain rules, whose antecedent is composed of the conditions to generate an argument, and whose consequent is this argument; this is the format of rules for argument generation. Moreover, in these algorithms, we can use a taxonomy of conditions and arguments with different levels of specificity in order to recognise the users’ pattern of argument generation in a more abstract way (see Sect. 5 for more details).

The evaluation of this proposal was carried out in the scenario of meeting scheduling. We worked with a group of 25 users who have to arrange meetings through a distributed application. To carry out this goal, users must reach an agreement in several aspects of the meeting (topics, place, time, date, etc.), and exchange proposals and arguments through the application to do this. So, we observed how users generated their arguments (we gathered 1,234 arguments) in four different situations, and separate the observations in two sets: training observations and test observations. Then, we built an argumentative model for each user from the training observations. To validate these models, we compared for each user the arguments that we can obtain using his/her argumentative model, versus the test arguments stored on the test observations. From that comparison we found that a 42.95% of test arguments were completely generated by the argumentative models, a 16.72% were partially generated, and a 40.33% could not be generated. Also, we compared the rules obtained with other works in the area of argumentation-based negotiation, for example, we automatically learnt several rules that had been explicitly defined in [5].

The work focuses on modelling the argumentative style of the user for several reasons. First, the user model is the baseline to assist the user in a personalised way, and due to the fact that there exists a wide variety of possible applications, we want to keep the modelling independent from its use.

However, although in this work we concentrate our efforts on the construction of the user argumentative models, we will not overlook its applicative side. Once the user argumentative model has been built, we can find several applications. User argumentative models can be used by a personal agent to assist the user during a discussion by suggesting automatically arguments according to his/her argumentative style. When the user is participating in a discussion, the personal agent could observe his/her participation and suggest arguments that help him/her to accomplish his/her goal in the discussion (e.g. reach a deal). As part of the evaluation of our proposal, we analyse and show how arguments can be generated from the user argumentative model. Note that the personalised assistance is directly performed from the rules, and it is not necessary to identify the type of the argumentative style to achieve this.

On the other side, building these models can be useful to discover and analyse users’ argumentative skills. Knowing these skills is relevant from several perspectives: (a) to allocate tasks that demand argumentation by prioritising users.