Group Decision Making Using Preferential Reasoning

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1 Problem Description

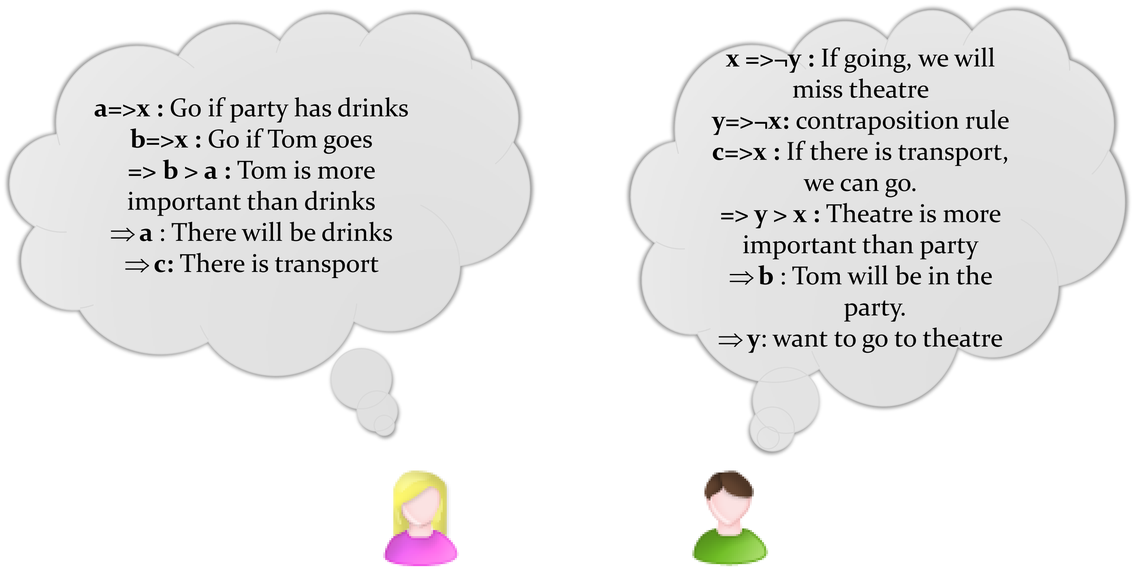
Problem

We assume a setting with two or more agents, having different knowledge bases and preferences but understanding the same language, that run in remote services and need to communicate, in order to agree in a common decision. Given that their KBs may be conflicting, the aim is to conclude to the optimal solution that less violates their preferences.

Contribution of this work

- Suggest a model that resolves the conflicts arising internally in an individual Knowledge Base.
- Describe a dialogue model between the agents (message types and protocol). The protocol of the dialogue is compared to the dialogue dame suggested by Prakken [1]. The difference with this work is that a player tries to attack the position of the other and there is a winner of the game, while in our model the dialogue is cooperative.
- Propose a non-exhaustive set of strategies, which ensures that the agents will reach as soon as possible the optimal decision, without having to exchange the entire information. Through these strategies, we make an effort to capture aspects related with human cognition in such daily dialogues.

2 Motivating Example



Subject of Dialogue: Go to the party (x) ?

3 Formalization Preliminaries

Language	***Positive Literals L^0*** : {a1, a2, ….} ***Negative Literals $L^{\neg}$:*** {¬ a1, ¬ a2, …} ***Preference Literals $L^{>}$:*** {(a1 > a2), …} Default Negation supported in the exchanged messages: ~x
Deductive System	**Set of Defeasible Rules** { =>a1, a1 => a2, =>(a1 > a2) … }

* The rules could also express ontological reasoning in case that the Knowledge Base is represented in RDF.

4 Single Agent Decision Making (SADM)

Inferable literal a: In any consistent subset K' with closure Cn(K'), a ∈ Cn(K').

Conflict Resolution Principle: A set of rules A is acceptable if it is consistent and, if (a1 > a2) ∈ Cn(A) and a1, a2 are inferable, then a1 ∈ Cn(A).

0-compomise: Maximal acceptable sets

Initial rule set

r1: => a1
r2: => a2
r3: a1 => a3
r4: a2 => ¬ a3
r5: => (a3 > a2)
r6: => (a1 > ¬ a3)

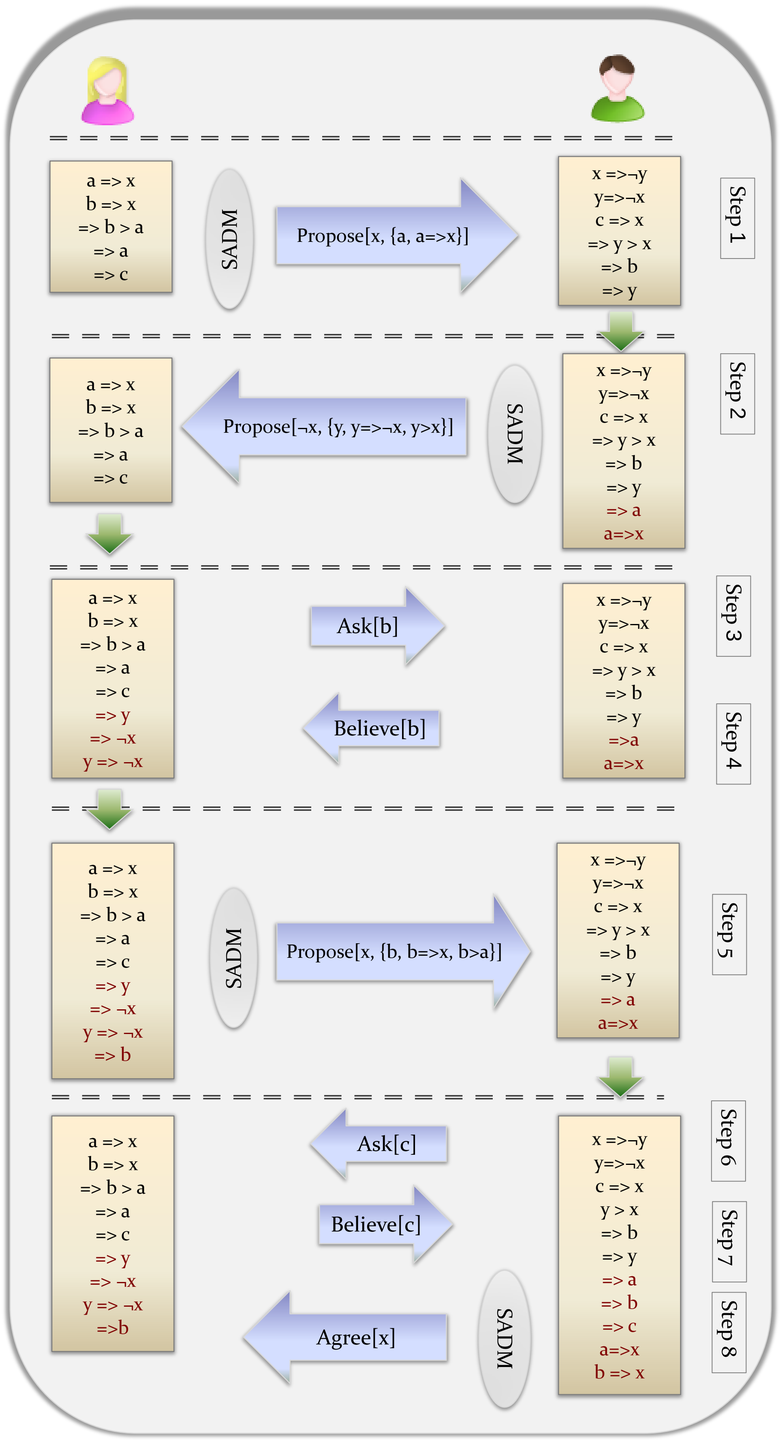
CR_ID	Acceptable Set	Decision	Compromise
CR_1	{r1, r2, r3, r5, r6}	a3	0- compromise
CR_2	{r1, r2, r3}	a3	1- compromise
CR_3	{r1, r2, r4}	¬ a3	0- compromise
CR_4	{r1, r3, r4, r5}	a3	0- compromise
CR_5	{r1, r3, r4}	a3	1- compromise
CR_6	{r2, r3, r4}	¬ a3	0- compromise
CR_7	{r1, r2, r3}	a3	1- compromise
CR_8	{r1, r2, r5}	a3	1- compromise
…	…	…	….

Some heuristics/criteria about the rules

H1: Preference rules more preferred that other rules.
H2: Amount of information it produces in conjunction with the rest KB.
H3: Fact rules more preferred than inference rules
H4: Provenance of the rule.

H1 > H2 > H3 > H4 => CR_1 ▷ CR_4 ▷ CR_3 ▷ CR_6

5 Group Decision Making



Messages types

- *Propose[x, Justification]* : Basic message type that carries the information.
- *Ask[x]:* Message type, used by an agent to ask the group about a literal he is not aware.
- *Believe[x | ¬x | ~ x]:* Response to *Ask* message.
- *Agree[x]:* Message to declare that an agent agrees with the last proposed literal.

Protocol rules:

- Start dialogue with an *Ask* or *Propose* message.
- The same move is not allowed to be played twice.
- Switching turn between the agents.
- One move in each step
- ***TERMINATING CONDITION:*** The dialogue terminates either with an *Agree* message or when the agents have no more moves.

Some strategies in move selection:
(This part is not formal yet. We present intuitively some first ideas)

- The resulting decisions from the most preferred conflict resolutions are communicated first.
- If there is relevant but not inferable information, it needs to be completed by sending *Ask* messages.

Final Decision: x
Go to the Party

Reference

[1] H. Prakken. Coherence and flexibility in dialogue games for argumentation. J. of Logic and Comp., 15(6):1009–1040, 2005.

Acknowledgments

This work was partially supported by the projects DIACHRON (ICT-2011.4.3, #601043) and PlanetData (ICT-2009.3.4, #257641)