Reasoning about Interaction for Hospital Decision Making

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1 The Problem, Plan of Research and Current Work

For our research, we present a model for reasoning about interaction in dynamic, time critical scenarios (such as decision making for hospital emergency room scenarios). In particular, we are concerned with how to incorporate a model of the possible bother generated when asking a user, to weigh this in as a cost of interaction, compared to the benefit derived from asking the user with the highest expected quality of decision. A detailed method for modeling user bother is presented in Cheng [1], which includes reasoning about interaction (partial transfers of control or PTOCs) as well as about full transfers of control of the decision making (FTOCs) to another entity. Distinct from Cheng's original model, attempts at FTOCs are in framed as PTOCs with the question Q: "Can you take over the decision making?". This then enables either a "yes" response, which results in an FTOC[1] or a "no" response or silence.

In Figure 1, one *world* consists of one PTOC, one FTOC, and one SG (strategy regeneration) node and includes all the parameters currently used to calculate benefits and costs to reason about interaction with entities. Therefore, when the current *world* is moved to the next step, our system asks a new entity. The number of worlds is equivalent to the number of entities that will be asked.

There are n FTOC nodes, n PTOC nodes, n SG nodes, and one virtual node in the overall framework with n worlds. We obtain the overall EU of strategy s by summing up n EU values for FTOC nodes, n EU values for SG nodes and one EU value for the virtual node as follows:

$$EU(s) = EU_n(dfl) + \sum_{j=1}^{n}(EU_j(fn_l) + EU_j(sg)) \tag{1}$$

where dfl[2] reflects a virtual node, n denotes the number of worlds, $EU(fn_l)$ reflects the utility of ending in a FTOC, and $EU(sg)$ reflects the utility of ending in SG node.

We are also interested in determining an appropriate reasoning strategy to find the right person, at the right time, to assist with the care of patients who are arriving at a hospital emergency room. Typically in these settings, patients who

[1] As a simplication, we assume that a "Yes" response results in the user successfully assuming control of the decision.

[2] The leaf node for the silence response is set to sg.

A. Farzindar and V. Keselj (Eds.): Canadian AI 2010, LNAI 6085, pp. 414–415, 2010.

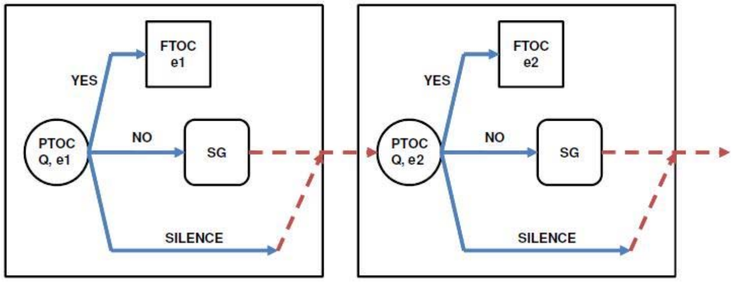

Fig. 1. Visual representation of strategy with the FTOCs and PTOCs; each world occupies one square

appear to require further assistance than can be immediately provided (what we could call "a decision") require soliciting aid form a particular specialist.

In order for the human first clinical assistants (FCAs) to make the best decisions about which specialists to bring in to assist the patients that are arriving, the proposal is to have our multiagent reasoning system running in the background, operating with current parameter values to suggest to the medical professionals who exactly they should contact to assist the current patient. These experts are then the entities $\{e_1, e_2, \ldots, e_n\}$ that are considered in our reasoning about interaction, with the FCA contacting the experts according to the optimal strategy our model generates (who first, waiting for how long, before contacting who next, etc.)

We model the cost of bothering users in detail, as in Cheng [1]. We propose the addition of one new parameter as part of the user modeling for the bother cost, a $Lack\_of\_ExpertiseFactor$. This parameter is used to help to record the general level of expertise of each doctor (i.e. medical specialist), with respect to the kind of medical problem that the patient is exhibiting. We introduce another new parameter, *task criticality (TC)*, to affect the reasoning about interaction. *TC* is used to enable the expected quality of a decision to be weighted more heavily in the overall calculation of expected utility (compared to bother cost), when the case at hand is very critical. This parameter may also be adjusted, dynamically. When a patient has high task criticality, strong expertise is required because the patient's problem may become much more serious if not treated intensively.

Our detailed bother modeling for time critical environments is an advance on other bother models [2]. We have validated our approach in comparison with the case where bother is not modeled, simulating hospital emergency decision making. Our current results demonstrate valuable improvements with our model.

References

1. Cheng, M., Cohen, R.: A hybrid transfer of control model for adjustable autonomy multiagent systems. In: Proceedings of AAMAS 2005 (2005)
2. Horvitz, E., Apacible, J.: Learning and reasoning about interruption. In: Proceedings of the 5th International Conference on Multimodal Interfaces (ICMI 2003), pp. 20–27 (2003)