Group Recognition through Social Norms

(Extended Abstract)

Daniel Villatoro
Artificial Intelligence Research Institute (IIIA)
Spanish Scientific Research Council (CSIC)
Bellatera, Barcelona, Spain
dvillatoro@iiia.csic.es

Jordi Sabater-Mir
Artificial Intelligence Research Institute (IIIA)
Spanish Scientific Research Council (CSIC)
Bellatera, Barcelona, Spain
jsabater@iiia.csic.es

ABSTRACT

This paper examines the decentralized recognition of groups within a multiagent normative society. In this work we explore different mechanisms that allow agents to recognize the others as members of a certain social group. Considering as the basic mechanism the one that makes agents interact with other agents without considering the previous interactions and with no communication, three new algorithms have been developed and tested to improve the efficiency of the basic one. These algorithms are: (1) the *whitelisting*, (2) the *blacklisting*, and (3) the *labelling* algorithm. Moreover, a reinterpretation of the definition of group is done in order to make it more dynamic and flexible with respect to the environment where agents are located. Analysis on simulation results confirms the effectiveness of this *dynamic member evaluation function*.

Categories and Subject Descriptors

I.2.11 [**Distributed Artificial Intelligence**]: Multiagent Systems

General Terms

Experimentation

Keywords

Social Norms, Groups, Multi-Agent Based Simulation

1. INTRODUCTION AND STATEMENT OF THE PROBLEM

Social norms provide multiagent societies with a decentralized control mechanism. By donating agents with a set of social norms to use in the environment where they are located, they can self-regulate it and control undesired behaviors. The definition of social norm [1] tells us that are "norms that emerge through the decentralized interaction of agents within a collective and are not imposed or designed by an authority", but does not specify what happen when someone violates the norm. The society need mechanisms to act in such situations, that is, *coordinated reaction against outsiders*. The coordinated reaction from the group is twofold: (1) a *coordinated punishment* from the group against the outsider who explicitly does not abide by the same social norms; and (2) an *integration mechanism* to force this outsider to change its actual behavior to the one accepted by the group.

Therefore, agents need to have a notion of social group, and it will be determined by the agent's behaviour (determined at the same time by the social norms it uses). In this way, a social group will be only formed by agents who share a set of social norms. Once agents possess this notion of social group they might be able to coordinate according to the situation in which they meet outsiders. In this work our contribution is twofold: (1) we *introduce different algorithms for the group recognition process and contrast their efficiencies in different situations* (reducing the number of members believed to be part of the group while they are not by taking advantage of the social information); and (2) we *introduce a dynamic member evaluation function*, redefining and making dynamic the concept of being member of a group.

Cite as: Group Recognition through Social Norms, (Extended Abstract), Daniel Villatoro, Jordi Sabater-Mir, *Proc. of 8th Int. Conf. on Autonomous Agents and Multiagent Systems (AAMAS 2009),* Decker, Sichman, Sierra and Castelfranchi (eds.), May, 10–15, 2009, Budapest, Hungary, pp. 1347–1348

2. GROUP RECOGNITION

We define a *social group* as a set of agents who are socially related, being conscious that they are socially related, and that interact with one another.

Two agents will know if they are socially related following a *similarity evaluation function*. This *similarity evaluation function (SEF)* will determine the degree of similarity between two agents. We will introduce two types of similarity evaluation function: an *static SEF* that will measure this similarity in a very naive way; and a *dynamic SEF* that improves the behaviour of the static function.

Before explaining the similarity evaluation functions we need to introduce another important concept. In our simulations, agents are donated with a *Friendship Factor (FF)*. This factor determines the minimum degree of similarity that two agents need to reach (by interacting and discovering the others' norms) in order to be considered socially related.

2.1 Static SEF

The most intuitive *SEF* calculates the percentage of known common norms that two agents share. In this case, one agent is considered to be "socially related" with another when they share (that is, behave the same way given certain conditions) a certain percentage of social norms. The threshold is determined by the *FF*. For example, a *FF* of 0.2 means that an agent needs to share at least 20% of the norms (where the 80% remaining can be unknown). As soon as a single norm is detected to be different, the two agents are no more "socially related".

2.2 Dynamic SEF

In this case, the SEF determines that **two agents are socially related if the sum of the relevances of the norms that they share minus the relevance of those they do not share is above the FF**. This function is designed to consider both the common and uncommon norms shared with other agents in order to calculate the similarity. The evaluation of the norm relevance is built during the execution of the simulation. This evaluation is personal of each agent, as it is built based on its own interactions with other agents. We have designed two different functions to evaluate the norm relevance (from now on Norm Relevance functions):

- *Frequency Based Norm Relevance*: The most intuitive idea to evaluate the relevance of each norm is considering that the most important norms are those used more frequently. Here, the relevance of a norm N is calculated dividing the number of times that the situation associated to norm N occurs, by the total number of interactions of any kind that such agent has had.

- *Benefit Based Norm Relevance*: We identify that the scenarios where the benefit function can be more useful are those scenarios where agents have a goal to fulfil (other than recognizing the group), and the fact of following the social norms makes the agents closer to their goal. In this case, depending on the scenario, agents will have different goals and therefore different ways of evaluating the benefit of a norm.

2.3 Algorithms

In the following section we will define the basic algorithm of group recognition, and new algorithms that improve the behavior of it. The new algorithms take advantage of the social information that agents are gathering during interactions and that can share with other agents through a communication protocol.

- *Basic Algorithm*: The simplest mechanism of group recognition is to allow agents to randomly interact among them and make themselves keeping record of how socially related they are. This algorithm makes each agent interacting with the rest of the society without any preference or intelligence in the partner selection process.

- *Whitelisting Algorithm*: It is based on the idea of recommending newly socially related partners to your already known socially related partners. When an agent discovers a new socially related partner (that is, the *degree of similarity* with that agent has gone above the *FF*), it will recommend to this new agent some of its other socially related agents as possible partners to interact with. If this agent does not know any of the recommended agents, it will add them to their preference list of agents to interact with in order to confirm this similarity.

- *Blacklisting Algorithm*: In this case, unlike the whitelisting algorithm, the idea is to inform about non socially related parters to the rest of agents in the social group. Once an agent is detected as a non-member of the social group, this information is transmitted to the other members of the group so they can avoid that agent in the future.

- *Labelling Algorithm*: The main idea here is that agents are able to assign "labels" to other agents that can be accessed by a partner when two agents interact. Each agent carries the labels that others assign to it. The content of these labels is: (1) the identity of the agent with whom it interacted, (2) the situation in which they interacted and (3) the result of the interaction. It is straightforward to see that the power of this algorithm is based on publishing and making accesible to all agents previous interactions with different agents.

3. EXPERIMENTS AND RESULTS

The performed experiments show that the *basic* algorithm for group recognition can be improved by algorithms (*whitelisting*, *blacklisting* and *labelling*) that take into account the social information and allow agents to communicate. These experiments also show that the defined Static SEF is too strict. Given that, a new similarity evaluation function has been introduced. This dynamic SEF needs of a norm relevance function (local to each agent) that specifies which are the most important norms. We have presented two different norm relevance functions. The experiments showed that better results are obtained for the Frequency based Relevance Function in scenarios where agents have just to recognize the group depending on the environmental conditions. On the other hand, the Benefit based Relevance Function is better when agents are given a goal to fulfill other than the group recognition.

Last but not least, the group recognition algorithms have been also studied through experimentation with the new dynamic evaluation function. The main conclusion that we can extract is that the Blacklisting algorithm is not as useful as it was with the static evaluation function. With the new dynamic evaluation function it is harder to recognize another agent as socially unrelated and the fact of communicating it does not improve the behaviour of the group recognition process. The next steps in our research will lead us to research about the coordination mechanisms in decentralized societies. This coordination mechanisms will allow agents, once groups are formed, to react against norm-violators or newcomers.

4. ACKNOWLEDGMENTS

This work was supported by the European Community under the FP6 programme [eRep project CIT5-028575]; the Spanish Education and Science Ministry [AEI project TIN2006-15662-C02-01, AT project CONSOLIDER CSD2007-0022, INGENIO 2010]; Proyecto Intramural de Frontera MacNorms [PIFCOO-08-00017] and the Generalitat de Catalunya [2005-SGR-00093]. This work was partially supported by the Santa Fe Institute. Daniel Villatoro is supported by a CSIC predoctoral fellowship under JAE program.

5. REFERENCES

[1] C. Bicchieri. *The Grammar of Society: The nature and Dynamics of Social Norms*. Cambridge University Press, 2006.