On Achievable Goals and Feasible Plans in Open Multi-Agent Systems

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Extended Abstract

In (Sichman 1995), we have proposed both a model and an implementation of a *social reasoning mechanism*, an essential building block for the design of really autonomous agents, immersed in an *open MAS*. By open, we mean that agents may enter and leave the agency whenever they want. As a consequence, agents have to *adapt themselves* to the changes in the environment: as services may dynamically become available/non available, they must reason about each other, in order to choose different goals, plans and possible partners to whom *coalition* proposals are to be sent.

Our social reasoning mechanism is based on the notion of *social dependence*. Briefly an agent is said to be *dependent* on another if this latter may facilitate/prevent him to achieve one of his goals. Agents use the information they have about each other to detect complementary expertise, by constructing *dependence networks*, that contain all their dependences. In our framework, we have adopted the following simplifications: *(i)* agents do not perform online planning. We consider that agents have pre-established plans in the domain application level and *(ii)* agents first choose a goal to pursue, and then a plan to achieve it. Eventually, if an agent can not execute the chosen plan alone, he will also choose the more susceptible partners to whom he should send a coalition proposal.

We say that a certain action is *available* if it can be currently performed by at least one agent in the agency. A plan is said to be *feasible* if every action needed to perform it is available. Finally, a goal is said to be *achievable* if there is at least one feasible plan whose execution achieves this goal.

We believe that a decision criterion based exclusively on the notion of goal's worth/plan's cost is *insufficient* to characterize open societies. It does not seem rational for an agent to choose to pursue a goal with greatest worth value, without analyzing if this goal is achievable or not. A similar argument holds for feasible plans. We believe that these notions are to be represented *subjectively* within the agents' minds, differently from a pure utilitarian approach, where all the agents' goals are considered to be achievable and the notion of goal is not usually represented explicitly within their minds.

The goal and plan decision mechanisms described above were implemented within the agents of the DEPINT system (Sichman 1995), as it is shown in the following example:

```
My dependence network is:
  ag1
 <ag1>
--------  write_mas_paper (20)
       |-------| write_mas_paper:=write_mas_section(),
       |       |                  process_word().
       |       |--------  process_word
       |                |-------  UNKNOWN
       |                        |--------
       |
       |  review_oop_paper (10)
       |-------- review_oop_paper:=analyse_oop_paper(),
                |                        process_latex().
                |--------  A-AUTONOMOUS
                         |--------

My current list of possible goals is :
   write_mas_paper(20) non achievable
   review_oop_paper(10) achievable

The goal selected is : review_oop_paper (10)
```

One may argue that using a decision theoretic approach, we can represent unavailable actions by ascribing them a very high cost. It seems obvious that such a model would not allow to implement an agent which differentiates between an action that is effectively very expensive from one that is not currently available in the agency. From a pure utilitarian approach, this lost of expressive power is not so critical, because at the end agents will not choose these plans. However, if we take instead a more mentalistic approach, this kind of information is essential, and must be explicitly represented within the agents' minds, as in our framework.

References

Sichman, J. S. 1995. *Du Raisonnement Social Chez les Agents: Une Approche Fondée sur la Théorie de la Dépendance*. Thèse de Doctorat, Institut National Polytechnique de Grenoble, Grenoble, France.