Simulation League, Team *Rogi2Team*, pages 121–125
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Description of Rogi 2 Team: Simulation

Rogi2Team

Josep Lluis De la Rosa, Bianca Innocenti, Israel Munoz, Ramon Montaner

JD, BI, IM, RM: Girona University

Abstract. *This paper describes the research in a new Rogi Team conceived by simulation in Java. It is a development of ideas for rational agents that co-operate and use revision of exchanged information and consensus techniques.*

1 Introduction

This research is implemented in JAVA. Next it will be applied to real platform of robots and especially to the 11x11-soccer server. A type of rational agents is imple-mented by techniques inspired from consensus techniques and according to new trends of agents' research for emergent co-operation design.

2 Rational Agents

2.1 Reactive Decisions

In a first step of reasoning, every agent decides a private action. This first decision is considered a BELIEF of the Agent0 language. This belief depends on local environ-ment configuration defined by two parameters: distance player-ball (DPB), and dis-tance player-goal (DPG). The belief contains a degree of certainty.

The procedure shows an example of configurations of robots and the ball in the field. Decisions are SHOOT at 'Zone 1', GET at 'Zone 2', and FORW or BACK at default 'Zone 3' depending on DPG value. Thus, reactive reasoning is the following rule:

BEL (AgentX, DPB, ZONE2) -> INFORM (to_any_agent, AgentX, SHOOT, 0.8) Similarly, at 'Zone 3' in point 'M' (see "Fig. 1b"), reasoning would be the following: BEL (AgentX, DPB, ZONE3) *BEL (AgentX, DPG,FAR) -> INFORM (to_any_agent, AgentX, FORW, certainty)*

$$f(c1, c2) = \begin{cases} 0 & , c1 > c2 \\ c2 & , \text{otherwise} \end{cases}$$

Figure 1:

where 'certainty' is a value obtained by fuzzy inference by operating the certainties of ZONE3 FAR Agents communicate their beliefs (INFORM in terms of AGENT0 language) to the playmates. Thus reactive reasoning creates rough intentions.

2.2 Rational (Co-operative) Decisions

Rational reasoning in the sense of [1] is implemented by communicating the former reactive beliefs. It begins with a REQUEST (a communication) action, so that every agent can know the beliefs set that contains the reactive belief, the certainty of this belief and the identification of the player (reactive_belief, certainty, ID_player) of all other playmates. Therefore, when two playmates realise they have conflictive beliefs then the certainty of their beliefs is taken into account and one of the play-mates changes its mind by reconsidering its former reactive beliefs.

Note that the exchange of beliefs and their certainties requires of revision [2]. This means that the subjective certainties associated to beliefs that are incoming from other agents have to be filtered (reviewed) at every agent. This proc-ess of revision is developed using extra knowledge about the co-operative world by means of some perception of quality and reliability of mates and of oneself [3] [4]. This reasoning procedure could be expressed as:

INFORM (Agent2, Agent1, BEL (Agent2, SHOOT, 0.7)) *BEL (Agent1, SHOOT, 0.2) -> BEL (Agent1, SHOOT, f(0.7,0.2))*

where

In the example of figure 1 since f (c1, c2) = 0 then Agent1 will change its belief to FORW or BACK action using the here described rules.

3 Implementation of the Team in the Javasoccer

COMMUNICATION of AGENTS' BELIEFS. When players already have their reactive beliefs about possible actions to do, then this belief is communicated to the playmates. Next, every agent reviews the incoming certainty of the incoming beliefs.

3.1 Communication of beliefs

Every player receives the beliefs from the others. The incoming certainty of be-liefs, certesa-_company is reviewed by means of the following rules

Prestige P_{ij} of a System S_i regarding S_j

$P_{ij}: [0, 1] \rightarrow [0, 1]$

$\varphi \rightarrow P_{ij}(\varphi) = P_{ij} \wedge \varphi$

Figure 2:

Necessity N_{ij} of a System S_i regarding S_j

$N_{ij}: [0, 1] \rightarrow [0, 1]$

$\varphi \rightarrow N_{ij}(\varphi) = \text{if } \varphi \geq \theta_{ij} \text{ then } N_{ij} \vee \varphi \text{ else } \varphi$

Figure 3:

that contain the perception of every agent of the community of agents in the co-operative world. This is implemented in prestige and necessity rules. This couple of parameters, defined as follows, describes the perception of the co-operative world, that is the perception that every agent has of the rest playmate agents:

The Prestige operator is implementable when using probabilistic Pij(f) = Pij f, or Sugeno's Pij(f) = min (Pij , f) implementation of the and operator.

3.2 Conflicts

This is the set of conflicts that agents should solve by means of the rational decision.

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Player \ Mate SHUT ATACK GO TO BALL CALL BACK
SHUT Conflict Conflict Conflict
ATACK Conflict Conflict Conflict
GO TO BALL Conflict Conflict Conflict Conflict
CALL BACK Conflict Conflict
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Alternative possible actions ATURAR (stop), DEFENSAR (defence), COBRIR (?), etc aren't conflictive in this example. In the case of no conflict then every agent decides to convert the reactive belief into an action.

3.3 Rational decision implementation in Java

An algorithm called consensus [5] [6] that recovers the perception of the co-operative world develops the reviewing process. The formulas are implemented using probabilistic implementation of the and logical connective.

if (decisions[decidit] *consensus[RobotID]* < *certesa_company* consensus[id_company]) // lets change the belief of this agent

4 Methods for Changing Perception of the Co-operative World

Java implementations of our rational agents show trends of better behaviour of the overall play of the teams, but there are still some lacks, as for example conflicts be-tween defenders and goal keepers, are not properly solved. Our improvement (nov-elty) is to modify the perception of the co-operative world to make the consensus algorithm more adaptive to changing environments: every agent modifies its percep-tion of the co-operative world. Two methods are proposed: (1) a positional method and (2) a reinforcement method for winners in conflicts to increase persistence.

4.1 Method 1: positional method.

Players are specialised. One possible effect of their specialisation is that they prefer to stay in certain position in the playground. Agents will take advantage of this fea-ture and will modify their vision of the co-operative world by assigning the values of prestige and necessity according to positions of players.

For example, the perception of the co-operative world from a forward-player could be: 'I have big necessity of the middle-forward players and not much necessity of the goal-keeper'. However, this perception has to be completed by more information according to the positions of the other playmates. This is the assignment of the pres-tige and necessity parameters:

Results of the method 1

Collisions in decisions are reduced compared to non-adaptive perception of the co-operative world but not eliminated. Prestige is assigned within the interval [0.5, 1] because every playmate deserves minimum credibility. Necessities vary in the interval [0, 1] but normally are low. Here follows that the behaviour of agents is as follows: when a player is far from the ball it will be passive or conservative and when the ball is closer it will be more active and aggressive.

4.2 Method 2: a positional method with reinforcement of winners in conflicts.

Necessity is understood as the confidence any agent has on its own possibilities. This is an auto-perception. Necessity could be thought as the need of going to the ball an agent has. For example, if a defender sees the ball in the attack zone (in the opponent field) then the necessity of this player could be very low because it is not its responsibility to go to fetch the ball. This necessity will be different depending on perception of the world that every agent has because of its specialised view and role.

Prestige is the perception of the co-operative world. It is the confidence on other playmates. Prestige that a player i is seen from a playmate j is based on using the necessity that player j has of going to the ball. This prestige, that it is initialised at a random value (0.5), will change during the game at every conflict:

The agent that has to modify its belief because of a conflict, and happens that its reviewed certainty is lower than the reviewed certainty of the playmate. We write down the identifier of the playmate who won the conflict and its decision.

At any moment again the agent has to modify its belief because of a conflict, then it will consider whether the conflict is with the same previous playmate. In this case, if the conflict is solved in the same way as previously then reinforce-ment learning will be used, to reinforce, by means of modifying the prestige, the persistence of the rational decisions of the agents.

Results of method 2

The improvement of this method is significative and highly adaptive. Almost collisions in terms of co-operative decisions are eliminated.

(The web pages of demos are under construction. If you have Javasoccer installed you can use provision-ally download the http://eia.udg.es/ peplluis/ou7kou.zip)

5 Bibliography

[1] Busetta 99.

[2] de la Rosa 92a

[3] de la Rosa 92b, 93

[4] Acebo 98

[5] de la Rosa 92

[6] Chi 92