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Identification of Associations between Cognitive Agents Using Learning Based System

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Abstract: The research is to pronounce the socialization with humans after identification of relationships between cognitive agents recognized with the perspective of focus, selective attention, intention and decision making. Machine learning is used to understand environment complexity, dynamic collaboration, noise, features, domain and range on different parameters. Range of view is an interesting approach for relationship identification with respect to time, distance and face direction in a settled boundary that are trying to answer socialized behavior between those multiple agents. In resultant, the system agent finds friend, best friend and stranger relationships between other agents by using top down approach. The application can play a wonderful role for security purposes, gaming, labs, and intelligence agencies etc.

Keywords: *cognition; relationship; perception; focus; attention; decision making; memory.*

1. INTRODUCTION

The confront pretended by the goal is gigantic and conjures up many analyzers yearly throughout the world to have interaction their heads towards the progress of ICub with detail research within the study of AI and Machine learning [1]. ICub has been used as an exploration challenge in parallel with a usage for academic purpose, and to stimulate the interest of the domain of laptop studies for artificial intelligence, machine learning and AI.

Here come a term of cognitive robotics regarding relationship and socialization in learning based system. In this technique, a phenomenon known Selective attention is of keen interest to psychologists. By this

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real-time performance can be achieved from the machine just like humans do. This will help to make the system socialize. Here for socialized mind, there is the need to know how human mind does work biologically and about their psychology[2]. Biologically the sensory cortex in parietal lobe is responsible for sensing a stimulus. After transmitting the message into the brain, human understand it and react according to it. Psychologically a human brain senses the input signals of the sensor's that are eye, ear, nose, touch and tongue. The behavior actually does the work in this flow: stimulus–sensation–sensory coding– perception.

Stimulus (humanistic motivation against anything) – sensation (stimulus sensation by any five senses) – sensory coding (Interpretation of stimulus by electrical and chemical signals) – perception (resultant image that becomes human brain for interpreted stimulus). In agent's mapping, Webcam is used for the vision purpose to perceive input data from an agent's parameters in iCub and learned material is the key to identify relationship among those virtual agents [3]. Depending upon human psychology there are two approaches for human visual selection Stimulus driven (bottom up) capture and goal-directed (top to down) selection. In this research both approaches can be used. 1st stimulus driven approach can be used for machine learning and to get the attributes of the observed agent and 2nd goal-directed selection can be used to find the relationship between the agents. The involvement of memory is must in the task if wanted to promote winning top-down strategies. Memory is used for different purposes like to save information about the agents and to retrieve information about the agents and memory is also used for decision making.

It is essential for virtual agents to act in a behavior like humans while conniving virtual humans. This necessitates robots to be stick in capability to determine and comprehend the surroundings in firm conditions. A method is developed that offers perceptual awareness that is based on the data present within the surroundings and the basic aligned combination of sanity detected as framework reliant that acts as an obligatory job to illustrate how an agent can course its surroundings to this end. However, if the surroundings is adequately intricate an agent can intellect the surroundings. For the agent to practically course there could be a lot data. Concentration is the aptitude to decide 1 pertinent facet from the surroundings. An agent may require to shorten its intellect exploration gap in way to construct more realistic virtual humans, maintaining only

the attractive or thought-provoking data thus adding up the sensible outcome of being unperceptive or neglecting.

To let virtual agents to recognize their surroundings [4], a global scaffold for representative sagacity and awareness is anticipated and executed. A comprehensive agent sensing scheme that permits imitation instigator to develop precise senses for a given imitation is included in this structure. A discernment scheme that uses a heuristic to create intellect consideration through a bottom-up and top-down course. A basic combination of forms of perception that allow for agents to combine perception attain the numerous intellections.

2. RELATED WORK

To acquire an idea of research direction for virtual and cognitive agent's relationship, some helpful researches gave many answers in this regard. Some following sections are presented a short survey of the main features of the systems to be studied.

At Massachusetts Institute of Technology by Dr. Cynthia Breazeal [5] as a trial in sentimental figuring Kismet is an android cranium made in the late 1990s [4]. The contraption was made to know and arouse sentiments. Kismet's communal aptitude software scheme, or (SNS) artificial anxious scheme, was premeditated with person models of intellectual performance in psyche. Kismet replicates sensation through a variety of facial terminology, verbal communication, and association. Facial terminology is fashioned through the appointments of the ears, eyebrows, eyelids, lips, jaw, and head [6]. Kismet has 6 sub schemes of example Low-level characteristic removal scheme, enthusiasm scheme etc.

Cynthia Brea fervor has demarcated numerous types of social agents in her current document on the theme [5]. It is charted the variety of agents as they boost in their aptitude to interrelate with humans in more ordinary customs for the human – through more multifaceted sympathetic and demonstration of social cues that humans normally use in communiqué [29].

This begins with communally reminiscent robots, robots that are fashioned in such a way as to support people to indulgence them as conscious matters [7]. Instance of this sort of robot are toys that are intended to draw people into an interface, but do not go auxiliary in stimulating a social coalition.

Another is a buddy model name robin. The robot was built to do interaction with the user having a disease known as cyber

bullying incidents [27]. It takes in five phase model. During interaction with the robot the buddy model should do the followings thing it welcomes the user, gather information, determine conversation objective e.g. Get tips how to deal with cyber bullying etc. Work out objective and Round off (buddy says goodbye) [8].

During the evaluation period of buddy, the interaction of the buddy was made by researchers, philosophers etc. They gave an opinion about the buddy and also tell the shortcomings present in the buddy model [5]. The buddy was good in interaction with the user to start which make him sociable whereas the researchers and philosopher tell that as the conversation precede, the buddy was unable to give facial expressions when it's about the disease and also when a buddy says he feel sorry for the patient having the disease, he starts laughing after saying this. So after recommendation of the philosopher the buddy is still in improvement [9].

During testing period the robot was tested with researchers, etc. To give their opinion about the robot. After a series of tests, the robot was good in interaction with the users, but still need improvement regarding generating emotions like face impression to his users [10].

TMSI is about the interaction of virtual agent's response to virtual agents mistakes. According to (TMSI), virtual agents depends on 3 erratic system, commune, rejoinder, rejoinder scheme plane. This study, manipulates unrestrained pragmatism and observe personage disparity, perform as an examination on authenticity of (threshold model of social influence) [11]. Unrestrained pragmatism not only includes the scope due to what it looks like a human (i.e., anthropometric pragmatism and picturesque pragmatism) but also how it performs it (i.e. faction pragmatism) and verbalizes [30]. This viewpoint, the fault formed by contemporary status of expected verbal communication dispensation serves to diminish the pragmatism of the virtual agent manners [12]. Preceding mechanism studies virtual agent common authority has classically paid attention on fault less virtual agents. It is separately manipulated virtual agents informal blunder. Based on the Threshold Model Social Interface, it is predicted that flawed virtual agent societal authority, if any, will be fewer than that of fault less ones [13].

Social Importance dynamic model (SID) is used to create socialization between agents. Here socialization is created using human cultures, which perceives agents from relational aspects [14]. Social importance dynamics model (SID) follows Status-

Power theory, which deals with acts or means which consider prestige, honor or social worth of agents for the purpose to create interaction [21] [22]. On the basis of these factors, attributes are set. By applying these attributes socialization between agents is decided. This model works on the basis of three phase's perceptions, deliberation and planning. In the form of perception agents is perceived along the basis of attributes and specify the aim of the ruler [15]. Following in the phase of deliberation for the purpose to create intention acts and goals are set. And in the last phase planning socialization between agents is decided on the basis of acts and goals.

Cognitive robot abstract machine (CRAM) is a memory management system which is designed to record information in the memory and it has no effect on the performance of the system for operation performing. Here agents learn from memory and decides why, how and what happened. This system provides a query interface which helps the robot to retrieve information from memory. CRAM remembers relationships between plans and sub plans [16] [17] [18]. It provides a description for the execution of the plan and after that robot takes a vision during the execution of the plan by using the information of the memory.

In agents, RPD model is utilized for decision making [17]. It actually works on the basis of experience in different situations. The first step is Experience matching and the second one is Experience execution. In Experience Matching step, On the basis of an experience set agents receive some information from the environment. The situation categorizes on the basis of context determined by the person. The chosen thing similar experience will be selected from the situation [18]. The two main advantages of this model are: First it helps to organize the different categories from different situations. Second one is that it reduces the number of comparisons. Improvement in execution efficiency of system in the case of a number of experiences is so large. On the Experience, Execution steps, Execution of the experience of an agent is performing the action on the different stages of experience [18]. By Hum DPM, an agent's experience may consist of single or multiple stages [19] [20]. Each stage must have a list of goals to achieve. The agent advances to the next stages of experience and constantly monitors virtual environment. Two conditions, the agent may get backward to the situation assessment. The final goal defined in the final stage of the experience is achieved or the expectancies of the experience are violated. In the first case, re-match of

experiences is done by the agent. And in the second case, the agent has to decide whether it needs to rematch to another experience by the reassessing [19].

Adaptive Resonance Theory is the way of learning in which long term memory and Short term memory for learning objects square measure accustomed save data. Sequentially, the object becomes the part of Short term memory and compares it with Long term memory data. If there is some information match in long term memory it shows the output that objects are same [20]. But if current object is not the part of any information in long term memory it just saves it in Long term memory and waits for another object.

3. PROPOSED WORK

Machine Learning is scientific disciplines that explores the construction and study of algorithm that can learn from provided data, and then apply the appropriate algorithm on the data to get output and on the basis of output result it have the ability to make predictions or decision making. Machine learning provides different algorithms that operate on specific trouble. This algorithm used to resolve a broad reach of critical applications, such as image recognition, optical character recognition and weather prediction etc.

Data from different perspectives used to be analyzed and used to summarize it for useful information by Data Mining. The maneuver of appliance erudition is comparable to so as to of "data mining". It let client to examine statistics from extremely diverse proportions, perspectives, classifies it and recapitulate to recognize associations. But data mining is functional to extract information for individual grasp. Contraption erudition takes out the data to advance the program's personal consideration. Contraption erudition software becomes aware of patterns in information and fiddle with program properties consequently. Diverse machine erudition algorithm is used that depends on the nature of the problem.

There is no generally accepted definition of agent in AI, for the purpose of this thesis; agents can be defined to be autonomous problem solving computational entities capable of effective operation in dynamic and open environments. Agents are often deployed in environments in which they interact and may be cooperating with other agents. So, common properties build agents totally different from the standard programs.

Agents are autonomous, that's they engaged on behalf of the user. Agents contain some level of intelligence, from

fastened rules for learning engines that permit them to adapt to changes within the atmosphere. Agents don't solely act reactively however additionally someday proactively. Agents have the social ability that's they impart with the user, the system and therefore the different agents PRN. Agents might join forces with different agents to hold out additional complicated tasks than they themselves will handle. Agents might move from one system to a different to access remote resources or perhaps to satisfy different agents.

Social intelligence enables social interaction between agents after identification of relationship. Recognize and identify the environment the socialized agents on the basis of learned information. The system puts attention to identify relationships and accelerate socialized environment. Relationship between agents is identified in socialized environment. Multiple agents can exist, but the system will identify a relationship with that agent which is the socialized agent for the system. Decision of socialized agent will be named along the basis of spending time and distance between agents in specified boundary. If the distance and spending time of agent will be according to specified time, then there will be a relationship between agents and agents will in socialized environment.

Before starting any procedure focus is generated. It is decided here that what should be focused on the environment. To identify the relationships between the agent system observes the whole environment and decides that which agent should be focused in a specified boundary. So when a new agent enters in the environmental system focuses on that agent.

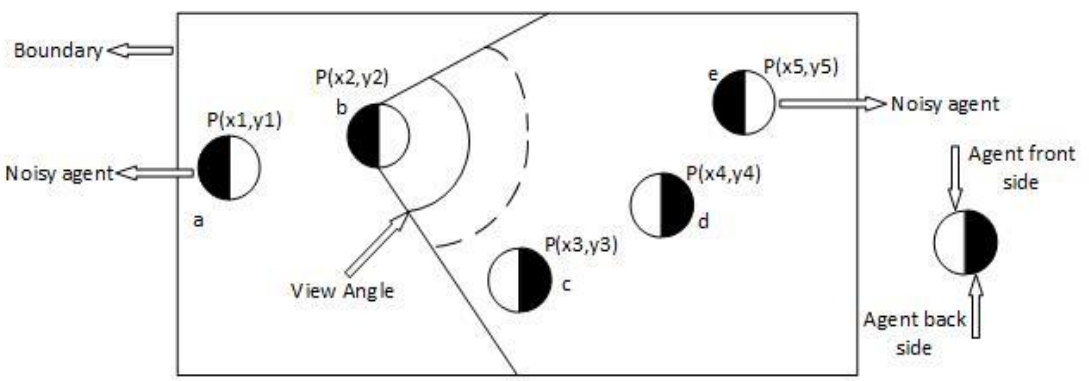

Figure 1: illustrate the vision perspective, according to agent b

Attention refers to cognitive process in

which priority is given to sensory and learned information about agents. On the basis of this learned information attention of the system will move toward that agent which has relationship with other agencies. The system will observe the multiple agents from the environment and will decide that which agent should be focused on the basis of spending time and distance in specified boundary and only system will give attention to that agent which will meet the specified criteria in a specific boundary.

As selective attention varies from one object to another, similarly agent will perceive another agent and selects that agent for attention and then shift its attention to the next agent who has entered in the domain area. Then it will be identified relationship with systemic agent.

One important thing is here that agents will neither focus on the agent which are outside the boundary and also nor pay attention on those agents. There will be called noisy. It's all about time dependent which spend two agents with each other.

On the basis of Recognition Primed Model (RPD), exactly two steps will be focused that is Experience Matching Step and Experience Execution Step. Agent will categorize the multiple agents or filter them for making decision. First of all, the system will use it for identification of relationship between agents. The agent will pay his attention to another agent and then shift it gradually on multiple agents. The system will minimize the agent step by step as Experience matching steps involves. After that system will show the relationship between agents using learning material. In the top-down approach, as the system will categorize the multiple agents and think or learning experience that which one is the best to fulfill its need. The system will minimize the agents who are not good so finally it will reach on the final decision and choose one and agent to assign tasks.

The visible sector of associate degree agent depends on many factors. Commencement of all we've the parameters visible Angle and sense step that determines the fundamental time step between visual info and the way several degrees the agent's traditional read cone is. This default values area unit one hundred fifty time unit and ninety degrees.

The maximum agent limit is 5 in a boundary. Assign a unique name to each agent as (a, b, c, d and e). The position of each agent that is represented by x and y coordinates assign unique position variables to each agent, as mention in above figure agent a assign P (x1, y1) and agent b assign P (x2, y2) and so on. Black color indicates the back side of the agent

and white color indicate the front side of the agent.

As above figure illustrate vision perspective with respect to agent b and view angles of that agent is 450 to 1350. There are three agents exists from the front side of agent b, where agent e and the agent a consider as noisy agent because agent b cannot see their faces. Now system focuses on agent c and agent d and calculates their distance with the perspective of agent b.

Distance between agent b and agent c is less than 3 meter that meets the criteria of socialization, then check face direction value of both agents if value of face direction of agent b is 2 and agent c face direction value

is 1, and if they impart and stick with each other 0-5 Sec then its mean the connection exists between these 2 agents is trespasser, if they stick with each other 6-10 Sec then its mean the connection exists between these 2 agents is friend and if they stick with each other up to ten Sec the connection exists between these 2 agents is ally, all these conditions fulfill the specified criteria of socialization. Now system shows output in which agent names are prompt that are

involved in a process of socialization.

Agent count = 5 (maximum)
Agent Head direction up and down is not considered
Socialization criteria are not checking for noisy agents

From head direction value table the three different values are taken which indicate the head direction of the agents. If the agent head is straight, then system assign head direction value is 1, if the agent head direction is left side, then system assign head direction value is 2 and if the agent head direction is right side then system assign head direction value is 3. Agent head direction up and down is not considered.

Table 1: Head Direction Values

Indication	Value
Straight	1
Left side	2
Right side	3

From body direction value table the three different values are taken which indicate the body direction of the agents. Systems observe the body direction of each agent and then assign appropriate body direction value against each agent. If the agent walk straight then system assign body direction value is 1, if agent turn left, then system assign body direction value is 2 and if agent turn right then system assign body direction

value is 3.

Table 2: Body Direction Values

Indication	Value
Straight	1
Left side	2
Right side	3

F (head direction, body direction)

Face direction value finds out as a combination of both head direction and body direction if head direction value is 1 (straight) and body direction value is also 1 (straight walk) then system assign face direction value is zero which indicate the focus direction of that agent is straight side.

If head direction value is 1 (straight) and body direction value is either 1 (straight walk) or 2 (turn left) or 3 (turn right) then the system assigns face direction value is 1 which indicate the focus direction of that agent is left side.

F (1 ➔1)0 indicates focus direction is straight side

F (1 ➔2) 0 indicates focus direction is straight side

F (1 ➔ 3)0 indicates focus direction is straight side

If head direction value is 2 (left side) and body direction value is either 1 (straight walk) or 2 (turn left) or 3 (turn right) then the system assigns face direction value is 1 which indicate the focus direction of that agent is left side.

F (2 ➔1) 1 indicates focus direction is left side
F (2 ➔2) 1 indicates focus direction is left side
F (2 ➔3) 1 indicates focus direction is left side

If head direction value is 3 (right side) and body direction value is either 1 (straight walk) or 2 (turn left) or 3 (turn right) then system assign face direction value is 2 which indicate focus direction of that agent is right side.

F (3 ➔1) 2 indicates focus direction is right side
F (3 ➔2) 2 indicates focus direction is right side
F (3 ➔3) 2 indicates focus direction is right side

Focus direction value depends on the value of face direction. If face direction value is 0 then its mean focus direction of that agent is straight side and system assign focus direction value is zero, if face direction value is 1 then its mean focus of that agent is left side and system assign focus direction value is 1 and if face direction value is 2 then its mean focus of that agent is right side and system assign focus

direction value is 2.

Table 3: Focus Direction Values

Indication	Value
Straight side	0
Left side	1
Right side	2

There are three parameters of socialization. Socialization between agents is checked using these three parameters if the distance between the two agents is less than or equal to 3 meters and they communicate and stay with one another minimum 5 sec and if the value of face direction of both agents either is 0 or other scenario, if the value of face direction of one agent is 1 and the second agent face direction value is 2 then these two agents are socialized because the criteria of socialization is fulfilling between these two agents.

Table 4: Socialization Parameter

Parameter	Value
Distance	3 meter
Face direction	head direction + body direction
Stranger	0-5 sec
Friend	6-10 sec
Best Friend	Up to 10 sec

Distance can be calculated between two agents using Equation below, each agent location can get using x and y coordinates.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

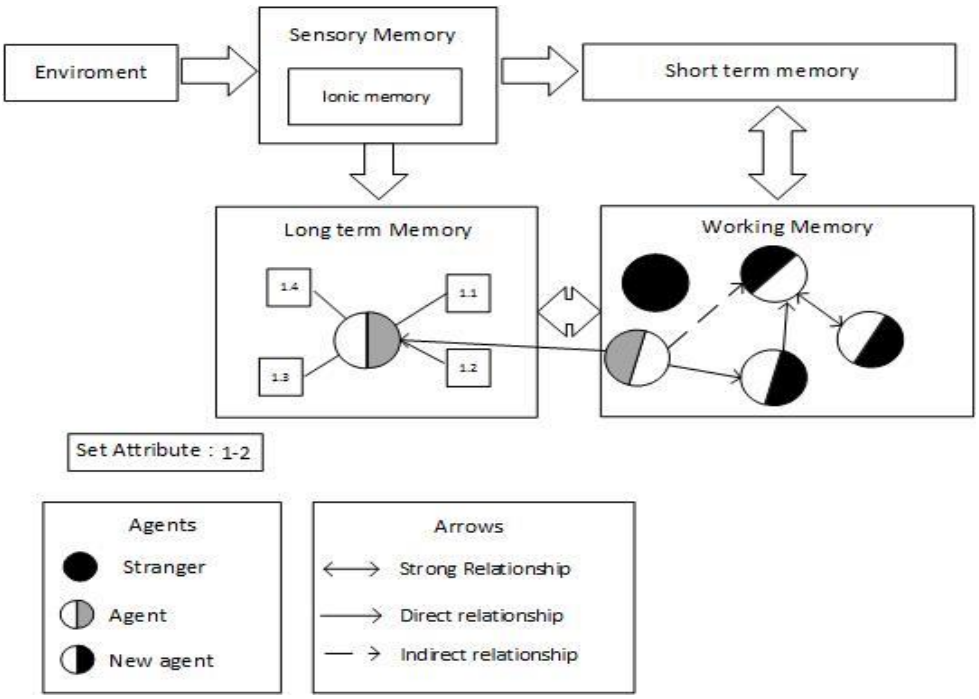

Figure 2: System working model

4. SYSTEM WORKING MODEL

System observes the environment with specified boundary. The system uses sensory memory in which Iconic memory buffer is used for the visual senses. When an agent enters in the boundary then system searches the currently seeing agent. Information about this current agent stores in short term memory then it moves toward working memory and its attributes are set.

After that multiple agents enter into the environment. To identify the relationships between these multiple agents these all agents handle in working memory. Agent with stored attributes moves from long term memory to working memory relationship identifies relationship on the basis of specified spending time and distance. Here three types of relationships are identified, the first strong relationship (represented by arrow heads at both ends), second direct relationship (represented by one headed arrow) and the third is not directly relationship (represented by dotted arrow). All other agents that do not connect with other agents, these agents consider as noisy agents. In strong relationship, both agents are socialized and both know

attributes of one another. In direct relationship one agent can set an attribute of another agent and communicate directly. And in case of indirect relationship one agent can't set attribute of another agent directly, for this purpose it needs the help of another agent to get information on that agent.

In demeanor exploration, the simulator characteristics that have been illustrated in this subdivision mutually make available some demanding surroundings. The iCub endows with a pragmatic field in the intellect that it holds loads of factual world involvedness that the mediator ought to knob. It is summarized in this part that the majority significant trait confronts of the iCub imitation surroundings. The main features characterizing the design of the iCub robot including the choice of sensors the robotic platform is equipped with are therefore here presented.

The iCub relation identifier is a imitational bona fide instance scheme that acts with distinct hiatus of instance hiatus (imitation series) every permanent 100 ms. Throughout this era the robot take delivery of diverse sorts of sensory surveillances from the surroundings and propel demand for acts. This necessitates factual instance conclusion production. It is merely at the last part of a sequence, on the other hand, that scheme carry out the acts and informs the condition of the surroundings. The scheme consequently employs the distinct exploit mock-up.

An agent uses the visual sensor. The visual sensor provides the agent with the information (distances, directions, etc.) about all the objects in his current field of view. Clamor is additional to the visual antenna of information by quantizing the values received from the environment. The view cone of an agent has a limited

width and as a result the agent only has a partial view of the environment, which causes large parts of the state space to remain unobserved. However, an agent can choose to trade off the frequency of visual massage against the width of his view cone and the quality of given information. An agent can perform different types of actions, which can be divided into two distinct categories: primary action (learning etc.) And concurrent actions (view, sense etc.). Sensing and acting in the iCub relation identifier is asynchronous. Visual information arrives and agents can perform concurrent action whenever he has the opportunity. This requires their ability to predict the current world state based on past perceptions.

It is also important to emphasize that iCub relation identifier is not simply for domain-

specific research. It shares characteristics with many other domains, applied to:

The techniques and algorithms that have been used in this project can be used for the security purpose of different army departments (atomic bomb security, etc.) As well as public departments (bank security, etc). iCub relationship increasing the likelihood that advances will span applications. Specifically, algorithms that have been developed and/or studied in iCub relationship identifier have also been identifier can be used in developing many different games etc.

5. CONCLUSION

We have seen teams and their methods for creating better relationship identifiers and got to the conclusion that they are far better than traditional approaches to AI and have great potential for solving those problems which traditional AI has failed to do so. But there also a great need for research in this field as machine learning algorithms lacks maturity in high level decision making skills. We have shown that each agent scenario introduces new issues and complications. In the identification of relationships between agents literature, several techniques and systems tries to address these issues. After summarizing a wide range of such existing work useful future directions are presented. Throughout the thesis, relationship identification approaches are emphasized. Although each domain requires a different approach, from a research perspective the ideal domain embodies as many issues as possible. iCub relation identifier is presented here as a useful domain for the study of relationship identification. In addition, collaborative and adversarial issues can be combined in real time situations.

6. FUTURE WORK

It has been observed that stronger commitment to previous decisions is also necessary for getting good results, but till now this has been ignored and most of the agents use a weak binding that is to select the new action at each state after observing only that state and this can dismiss the previous action selected in the last state. There is great need for work in this area. There is also a need of efficient and extended identification mechanism so that agents can identify the relationship like a real human. Another area that can be improved is that agents can switch their role and can change their formations. This holds big advantage during different game sites.

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