Issues of Emotion-Based Multi-Agent System

ARUSHI THAKUR
IES Group of Institute, Bhopal - 462052 (M. P.), India,, arushi18.thakur@gmail.com

DIVYA RISHI SAHU
S-671, Nehru Nagar, Bhopal - 462052 (M. P.), India, divyarishi.sahu@manit.ac.in

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[1]ARUSHI THAKUR & [2]DIVYA RISHI SAHU

[1&2]CSE - Department, IES College, Bhopal
[1]IES Group of Institute, Bhopal - 462052 (M. P.), India, [2]S-671, Nehru Nagar, Bhopal - 462052 (M. P.), India
E-mail : arushi18.thakur@gmail.com[1], divyarishi.sahu@manit.ac.in[2]

Abstract - Emotion plays a significant contribution in perceptual processes of psychology and neuroscience research. Gently, area of Artificial Intelligent and Artificial Life in simulation and cognitive processes modeling uses this knowledge of emotions. Psychology and neuroscience researches are increasingly show how emotion plays an important role in cognitive processes. Gradually, this knowledge is being used in Artificial Intelligent and Artificial Life areas in simulation and cognitive processes modeling.

Researchers are still not very clear about working of mind to generate emotion. Different people have different emotion at the same time and for same situation. Thus, to generate artificial emotion for agents is very complex task. Each agent and its emotion are autonomous but when we work on multi-agent system. Agents have to cooperate and coordinate with each other.

In this paper we are discussing the role of emotions in multi-agent system while decision making, coordinate and cooperate with other agents. Also, we are about to discuss some major issues related to Artificial Emotion (AE) that should be considered when any research is proposed for it.

In this paper we are discussing the role of emotions in multi-agent system while decision making, coordinate and cooperate with other agents. Also, we are about to discuss some major issues related to it that should be considered when any research is proposed for Artificial Emotion (AE).

Keywords - Emotion, Artificial Intelligence, Multi-agent System, Artificial Emotions.

I. INTRODUCTION

Areas of computer science such as Artificial Intelligence and multi-agent system employed heuristics like human emotions to organize their complexity. Human emotions play a vital role in area of artificial intelligence as heuristics, however human try to resolve problem. 'Marvin Minsky boldly' stated that "The question is not whether intelligent machines can have any emotions, but whether machines can be intelligent without any emotions" [1]. Emotions are a crucial part of the believability of characters that interact with humans [6, 3]. Multi-agent systems provide interface where individual agent is supposed to be autonomous. Applications related to practical and real life based on decision-making concepts (probability and utility) and rules (maximizing expected utility) will leave an agent with multiple actions or plans with slightly equal preference. This gives rise to no determinism in an agent's decision making, which is a problem if the agent has to choose only one of the options. In this nondeterministic state each agent has to interact with other agents. Most of the time human involves emotion in decision making as well as interaction and communication with others. Human in communication process utilize messages that contain four factors: facts, relationship, appeal and self-revelation [5]. Emotion is a crucial element to model perception, learning, decision process, memory, behavior and others functions they are interested in.

II. ARTIFICIAL EMOTION

Different explanations of emotion are proposed from different point of views as neuroscience, philosophy, social and culture studies. Different theories focus on different aspects of emotion. But in broader sense they all share a common concept that is known as FUNCTIONAL VIEW of emotion. It says that emotion is an output (or action) to serve a purpose or to satisfy its environment for a given set of input (or events).

When any event occurs, emotion plays a role to react. There are two ways of how to react. First way is to think all the output first and then conclude which one easy to react or implement. On the other hand second way is to compare the event with the previous event's database and then decide the action. In both of the cases system has a purpose to serve and an environment to satisfy and to act with.

Role of emotion in biological point of view is still not very clear. Different people react different in same situation. There are three layers of behavior. First is memory of previous events, Second layer is mood and third layer is personality. Thus, Emotions differ from person to person at the same time and same condition. So when we talk about artificial emotion, to construct a set of subsystems which will produce emotion, is very complex.

III. COOPERATION & COORDINATION AMONG AGENTS

Since a long time Human Computer Interaction (HCI) community is trying to make a system that can interact with others with emotions as human do. Now a days, Some robots have been introduced who communicate with users and its results are also very satisfactory. Some review articles for this are also available [4,7]. Now, in multi agent system, If agents, which have to cooperate with each other, know how they work internally, they can anticipate expected actions. For example: If an agent know that another agent working on a task to achieve a common goal and also having so much work load, at this time, an agent can contribute or coordinate with the other agent to avoid failure. An agent could achieve this by mapping the perceived state of another agent to its own mechanism and approximate the affective state of the that agent and by this mechanism it can then predict what actions the other agent is most likely to perform next after decision making by using of heuristic. If all agents were using an affective mechanism as a heuristic for their decision making, this kind of cooperation can be achieved in much the same way as humans do in their interactions.

IV. MAJOR ISSUES

For some years, experimental research using emotion-based agents is being developed. We could mention [2], which measure emotion as behavior modulation. Next [8] in which, different levels of an artificial hormone mechanism generate emotion.

A. COMPLEX TO UNDERSTAND

Considering current state of the running projects, to make an emotion-based system is far from simple and straightforward job. Even computational concepts of emotion are as problematic and complex as computational understandings of human being's emotion and their normal life.

B. LACK OF FRAMEWORK

A well defined scientific framework is needed for achieving "Artificial Emotions". Some research works (e.g. [12], [10], [9]) show advanced knowledge and concepts to follow, approaches that might be successfully used to model artificial emotions in agents.

C. LACK OF TRUST

Another issue is lack of trustworthy result. The question is "how much can we trust on an emotional decision?" When an agent predict the action that another agent is most likely going to perform, and take an action for coordination, so how much is it trustworthy that the another agent would really take the same action that is predicted.

D. COMPARISION STUDY

Another important issue is to comparisons between projects and also within same project, with comparative results from emotion and non-emotion-based experiments.

V. ISSUES WITH ARTIFICIAL EMOTION

When we talk about artificial emotion, we have to decide the levels and limit of emotion. For example if we say "care" emotion so at what extent system should express care emotion. In real life, if a person is too much caring for someone, it becomes possessiveness and too much possessiveness becomes hard to accept and sometime dangerous also. So caring should have some limit. In the same way there should be some limit in artificial emotions. But the problem is how you would decide the levels. Or how will you calculate the levels. What would be the "primitives" and "starting point".

Some authors say that there are two important things: set of inputs (events) and environment. Now design architecture to serve a purpose and act as output. It would have some primary emotional responses and then leave the subsystems to cooperate and produce a final emotion and action. Some can argue that there should be a mechanics in each agent's subsystems that will produce emotions using primary emotional responses. But problem with this approach is Uncertainty. How would you know what the system will react after an event. We will never know whether we will get what we want or not.

Another major issue to test the correctness of emotion, it can be done by comparing the outcomes from the system behavior with the outcomes that would be produced by equivalent biological system. But it is very hard to implement.

VI. FUTURE RESEARCH AND CONCLUSION

We are currently working on the OCC model that is trying to formalize and implement 22 deliberative emotions [10]. OCC model is used as heuristics for controlling the situation of no determinism in goal-directed agents. The OCC model has been used for emotion synthesis. This model is very suitable for formalization but we focus to broaden our research with other alternative theories of emotion. Recently, we are formalizing the whole set of 22 emotions in an extension of the KARO framework [13, 11]. We expect to accomplish this by allowing agents to map the perceived states of other agents to their own affective model, which will allow agents to approximate the goals and plans of other agents as they reason about their own. As soon as neuroscience researches increase, they might be more and more useful in the construction of emotion-based multi-agent systems. Computational projects with particular focus will be able to extend their scope to achieve this goal.

In this paper, we have mentioned three problems in emotion-based multi-agent systems, namely no determinism situation in decision making, cooperation and coordination in multi-agent systems, and believability.

By overcome these challenges can be a very important step to go beyond currently available engineering applications and towards a more scientific discipline of computer science ([14]).

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