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MULTI-AGENT PARADIGM FOR LEADERSHIP SELECTION: A REVIEW

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Abstract: A Multi-agent System (MAS) is comprised of multiple interacting intelligent agents. Agents in the MAS could all be of same type (homogeneous) or different (heterogeneous). MAS are used to solve problems which are either difficult for an individual agent to solve or when the problem is inherently comprised of multiple actors interacting together. However, the nature of MAS design coordination among agents in MAS is always a core issue. Coordination and cooperation allows the agents to manage their inter dependencies and the type and nature of interactions. Coordination and cooperation differ in degree of inter-agent knowledge and beliefs. Agent coordination is usually achieved in the backdrop of a communication system between agents. This paper is a based on the review of various work on selection of multi-agent for various task domain.

I. INTRODUCTION

The dynamics of various social and economical phenomena involves a non-linear complex set of interactions, which makes it very difficult to understand and analyze them. The traditional modeling and simulation techniques focus only on the macroscopic dimension and hence often fail to analyze these emergent phenomena. Recently, computational sociologists have started experimenting with agent based modeling as an alternative analytical formulation.

Agent based models (ABM) of multi-agent system (MAS) is a bottom-up approach which starts with identification of constituent agents of a system and their behaviours. It tries to model the heterogeneous agents and their interactions. The agents evaluate their state and that of their surroundings and interact on the basis of a set of behavioural rules. Even a simple agent model may exhibit complex emergent behaviour and provide insights into the system it emulates.

In this paper, we have performed the review of some reported works on ABM and MAS in leadership selection of social influence theory, course selection in e-learning system, and packet delivery in B2B e-

commerce. Review is based on specific methods for coordination, cooperation, coalition, and negotiation between different types of agents as per the domain required.

AGENT BASED COORDINATION AND COOPERATION FOR AGENT SELECTION USING SOCIAL INFLUENCE

Various social influence that determine individuals selection are such as organization, neighbours, his age, experience, background, knowledge, occupation, education, qualification, knowledge to work as a leader, marital status, etc; these are the few factors that are important when it comes to choose the leader for selection for any task. In selection social and economical behavior, an important question is how individuals choose a leader. To be clear, whether each member of the organization makes the decision to choose for a particular leader independently, or if the organization discusses and decides who gets all their selection or decision from the household or society. Trust is a set of expectations that lead to behavioral intentions that involve potential loss, because of the absence of control over those upon whom one depends. Trust is defined as "reliance upon the characteristics of an object, or the occurrence of an event, or the behavior of a person in order to achieve a desired but uncertain objective in a risky situation" (Giffin, 2004). This trust typically consists of the three trust dimensions: intelligence (corresponding to ability), good character (honesty and integrity), and good will (benevolence). Rotter (1971) also defined trust as "an expectancy held by an individual or a group that the word, promise, verbal or written statement of another individual or group can be relied on". Again, trust is defined as a situation-specific expectation or belief that determines behavior.

For the leadership selection, every individual while deciding his selection preference to choose his leader is directly or indirectly affected by a number of factors. The final decision for leader selection of an individual can be taken as a function of these factors. An individual makes a preference about a political party in a leadership based not only on his perception about the ideology & programs advanced by it, but by several other important factors. Individual may have an inherent selection preference formed over a substantial period of time from his perceptions. However, organization, friends, neighbourhood (representing social and religious group membership) and mass media play an important role both in shaping an individual's perception and deciding his final selection for choosing any leader. Organization of an individual represents the agents close to him and with whom he interacts very frequently. Organization members are known to have a greater influence over an individual. Neighbours are relatively distant agents and are viewed to represent individuals belonging to same social and

religious groups of the concerned individual. An individual is thus believed to be affected not only by his friends and organization members but also by the social and religious groups he may belong. Mass media also plays role in shaping an individual's selection preference for selecting a leader.

AGENT BASED COALITION FORMATION OF COURSE SELECTION STRATEGIES IN E-LEARNING SYSTEM

Computational models of human collective behavior offer promise in providing quantitative and empirically verifiable accounts of how individual decisions lead to the emergence of group-level organizations. There is a growing realization across the social sciences that one of the best ways to build useful theories of group phenomena is to create working computational models of social units and their interactions, and to observe the global structures that these interactions produce. Agent Based Models (ABMs) in MAS describe interactions among individual agents and their environment, and provide a process oriented alternative to descriptive mathematical models. Different situations and systems are characterized by the presence of autonomous entities whose local behaviors (actions and interactions) determine the evolution of the overall system. ABMs are particularly suited to support the definition of models of such systems and also to support the design and implementation of simulators. Recent ABMs provide compelling accounts of group pattern formation, contagion, coalition and cooperation, and can be used to predict, manipulate and improve upon collective behavior.

In Agent Based Modeling (ABM) a system is modeled as a set of autonomous agents, who can perceive environment and act on the basis of some behavioral rules. The agents represent the actors in the system; environment represents the surroundings including neighboring agents; and the behavioral rules model the interaction of the agent with other agents as well as with the environment. ABM in MAS can be used to model a number of phenomena in varied domains like market and economy, organizations, the World Wide Web and social systems etc. Availability of fast and cheap computing power, coupled with other advances in social sciences has paved the way for use of ABM as a favored modeling and simulation technique. Since last few years ABM has become the frontrunner tool of the sociologists and psychologists who tried to model social behavior, particularly the behavior of groups. The need for system that consists of multiple agents that communicate in a peer-to-peer fashion is becoming apparent. Central to the design and effective operation of such Multi Agent Systems (MASs) in ABM are a core set of issues and research questions that have been studied over the years by the distributed AI community. If a problem domain is particularly complex, large or unpredictable, then the only way it

can reasonably be addressed is to develop a number of functionally specific and nearly modular components (agents) that are specialized at solving a particular problem aspect. When interdependent problems arise, the agents in the system must coordinate with one another to ensure that interdependencies are properly managed.

Agent technology in MAS is a good approach for solving a number of problems concerned with personalized learning. In personal learning contexts individual students are given an environment that takes into account of their needs, interests and aspirations, and this is intended to lead to an enhanced learning experience. The aim of this chapter is to show how agent systems can not only form a good framework for distributed e-learning systems, but also how they can be applied in personal learning contexts where the learners are autonomous and independent. We present an e-learning scenario where students of university try to register for their preferred courses but where courses will only run if enough students register. In this context, we introduce, a prototype of an agent based voting system in e-learning, where autonomous software agents vote on behalf of the students. We present a voting strategy that student agents could use. Finally, through simulation we empirically investigate the resulting satisfaction of the students in the system. Multi Agent Systems are being used in a wide variety of applications, ranging from comparatively small systems for personal assistance, to open, complex, systems for industrial applications. In e-learning, Zucker (1986) has defined trust as a set of shared social expectations that are essential for and determine social behavior, enabling individuals to respond to each other without the explicit specification of contractual details. Similarly, (Korsgaard et al, 1995) argue that trust is the confidence that team members have in the good will and honesty (that is to say, benevolence and integrity) of their leader, while Hart and Saunders (1997) have defined trust as the confidence that another party will behave as expected, combined with expectations of the other party's good will. This trust is composed of a perception of the partners' competence, openness (the willingness not to withhold information), caring (not taking unfair advantage), and reliability. McAllister (1987) defines trust as "the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another" , that is, as a behavioral intention based on beliefs. Kumar and Ramaswami et al (2000) define trust as dependability based upon perceptions of procedural justice—fairness in managing a relationship, policies and procedures—and distributive justice—the perceived fairness of outcomes. Rousseau et al (2005) defined that trust deals with "the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another".Multi Agent Systems appear to be a promising approach to deal with the challenges in educational environments.

They can provide new patterns of learning and applications, such as personal assistants, user guides and alternative help systems, which are helpful for both students and teachers. It has been argued that using Multi Agent Systems to design educational systems can lead to more versatile, faster and lower cost systems. Agent technologies could allow us to take this personalization to new levels. In particular, consider an online university that has an open enrolment for adult learners to work towards a qualification (or a given set of skills needed for a particular job). Adults seek courses to match their own requirements, but the university can only run courses that have sufficiently high interest. An agent framework enables the students and university to negotiate which courses students select, and therefore which courses will run.

Cooperation is a key process in many Multi Agent Systems. Coalition formation, viewed as a general principle in social systems of e-learning, is an important cooperation method and has received a lot of attention. In many Multi Agent Systems self-interested agents can operate more effectively by forming coalitions and coordinating their activities within each coalition in e-learning. These efficient methods for coalition formation are of key importance in Multi Agent Systems. Coalition formation involves three activities: coalition structure generation, solving each coalition problem and dividing the value of each coalition among member agents. Agents form groups to achieve a goal, and utilize resources of subjects.

AGENT BASED NEGOTIATION STRATEGIES FOR PACKET DELIVERY PROCESS IN B2B E-COMMERCE SYSTEM

An agent is a software program that acts flexibly on behalf of its owner to achieve particular objectives. For B2B e-commerce the negotiating software agent must be capable of making decisions about what actions to take without constantly referring back to its user; he should be able to respond appropriately to the prevailing circumstances in dynamic and unpredictable environments; and he should be able to act in anticipation of future goals so that its owner's objectives are met, it describes a model for multi-agent negotiation under time constraints on an agent-based marketplace for personnel acquisition. Time constraints mean that all agents acting on the e-marketplace have deadlines for their activities. The model also describes the pre-selection procedures of agents. All negotiation strategies and negotiation protocols are heavily using the agents' deadlines. For multi-lateral negotiations they propose a negotiation protocol based on the bilateral protocol and a partial order of the set of all agents generated by a pre-selection procedure. A model for multi-lateral negotiations under time constraints in the framework of an electronic agent-based marketplace for personnel acquisition was presented in this

work. For the special situation under consideration negotiation issues and negotiation strategies were constructed first. Using the bilateral model and the partial order of the set of all employees' agents created by the pre-selection procedure, the case of multilateral multi-issue negotiation was discussed. The main idea behind the model is that not only issues under negotiation (like salary per hour, extra pays, number of working hours per week, and duration of employment) but also some other issues not directly involved in the negotiation (like age, working experience, professional and additional skills) are considered in the protocol for the multi-lateral negotiation. The model introduces for each agent a partial order of the set of all agents which are suitable for negotiation with the given agent. This partial order is then used in the negotiation process. System by specifying a profession, salary per hour, social benefits, number of working hours per week, the period of employment, professional and additional skills, age, professional experience, and a negotiation strategy.

Cognitive parameters are not used but computational deterministic negotiation model has been deployed. In the pre-selection process some additional factors like profession, age, working experience, professional and additional skills of the employees are taken into consideration. MAS have also been used to represent the clients and sellers / developers as agents and the broker as a coordinator agent. In this model the job of the coordinator agent is to take the required items from the client agent and to find out the proper, best and trusty seller / developer agents who can supply the items to satisfy the trust of client agent and constraints on the requirement of the client agent as well as on the seller / developer agents in supply of the items. The client agent constraints are related with price, quality, quantity, brand, payment mode, trust of product, time, etc. The seller / developer agent constraints are related with the price, quality, quantity, brand, trust, payment mode, payment type, address mode, etc. In MAS negotiation product brokering, cognitive parameter based selection, and monitoring have been incorporated by some of the researchers. In this part, we define "Agent Based Model in MAS of B2B E-Commerce" in 2-stages: (1) need identification, (2) brokering (product brokering and merchant brokering). We first describe our models. The proposed model consists of two stages of CBB (Client Buying Behavior) model of B2B E-Commerce. These stages are: need identification, seller / developer selection and negotiation through broker agent.

In this model there are three types of agents with their different functionality. Client Agent is the agent who needs to buy some items from another agent. Seller Agent / Developer Agent are the agent who sells items to the client. Broker Agent (Broker) is the agent who acts as a mediator between client and developer. He identifies all the need of the client agent and then selects the

best seller / developer agent for good product by evaluating the profile of the various agents and finally negotiates between client and developer agent in B2B E-Commerce.

Weigert, Rousseau et al (2005) also note that trust differs depending upon the history and nature of the relationship between the parties. Dwyer et al (1985) define trust as a set of beliefs relating to the exchange partner's ability and willingness to take part in the social exchange. Moorman et al (1970) define trust is "a willingness to rely on an exchange partner in whom one has confidence". Morgan and Hunt (1980) regard trust as confidence in another person's reliability and integrity. Ganesan (1995) also defines trust as a willingness to depend upon another, based on beliefs or expectation resulting from the partner's experience, reliability and benevolence. Giffin (1967), in the context of e-commerce, defines trust as a single dimension construct dealing with a consumer's assessment that the vendor is trustworthy, based on Luhmann's (1995) definition of trust as a social complexity-reducing mechanism that leads to a willingness to depend on a vendor; this willingness is derived from the perception that the vendor will fulfill its commitments.

The broker based MAS negotiation is performed for the merchant brokering, information brokering, and product brokering as well as coordination between buyer and seller agents. A MAS can be considered as a negotiation system, in which different broker roles are involved for different goals. The system realizes brokerage in the electronic commerce domain. The brokerage services enable users to browse through a directory or a classification until they find the appropriate information. They then provide attribute / value pairs until they finally get the information required. There are two technical sets of recommender systems: The negotiation between the client agent and the developer agent is based on constraints given to agents. The brokerage functionality is completely taken into account by the marketplace. It has to match up agents interested in the same goods. When a developer agent is created, the market place has to give to it a list of potential buyer agents and inform all potential client agent of the existence of this new developer agent. The multi-agent-based system is concerned with the brokerage functionality for the electronic commerce activity. Client and developers agents are represented by pro-active, autonomous, co-operating agents. The originality of this broker is in the use of a collective memory to find a relevant agent and in the learning process that updates the knowledge of the collective memory at several levels. The system is implemented in Java with NetLogo, the communication between the broker and the user domains is developed with NetLogo for communicating and negotiating between client and developer agents.

II. CONCLUSION

Some observations have been made from the literature review given above. It is observed that a large number of Multi-agent based negotiation approaches have been reported in the literature. Very limited numbers of works are available which try to implement the cognitive parameters for selection of agents in negotiation. These works also provide the implementation of limited number of cognitive parameters for coordination, cooperation, coalition, and negotiation approach. There is no complete deterministic computational model for cognitive parameters. Further due to availability of many types of cognitive parameter computational model (both probabilistic and deterministic model) using different domains, it may also always confuse the developer of a multi agent based system to select a particular approach to meet his requirement for negotiation among the agents.

It is also observed that the use of software agent in e-learning and e-commerce system is considered to be very important as is also discussed in the "Agent Mediated Electronic Learning and Electronic Commerce". The software agent can be highly beneficial to achieve high degree of automation such as security, trust, payment mechanism, advertising, logistic and back office management in field of e-commerce. It is also found that the reported literature on agent based negotiation in e-commerce provides a limited modeling for the selection of potential, dynamic, and trusty (best) agent. So a cognitive, business and customer orientation based potential agent will be a valuable advancement in the related field.

A Multi-agent System (MAS) is comprised of multiple interacting intelligent agents. Agents in the MAS could all be of same type (homogeneous) or different (heterogeneous). MAS are used to solve problems which are either difficult for an individual agent to solve or when the problem is inherently comprised of multiple actors interacting together. However, the nature of MAS design coordination among agents in MAS is always a core issue. Coordination and cooperation allows the agents to manage their inter dependencies and the type and nature of interactions. Coordination and cooperation differ in degree of inter-agent knowledge and beliefs. Agent coordination is usually achieved in the backdrop of a communication system between agents. Depending on the type of MAS formulation, different schemes of coordination and cooperation may be used. Cooperation is generally seen when agents in a MAS are directly aware of each other and work towards a common goal. Coordination and cooperation processes & mechanism vary with the kind of MAS formulation used, namely *centralized* and *distributed.* Centralized task structure and task allocation based coordination schemes have the advantage that it is more efficient to manage multiple agents working towards a common goal. Moreover, it requires less

communication and the solutions are often obtained within reasonable computational cost and time. The distributed coordination scheme, on the other hand, has the advantage that the individual agents have more freedom and flexibility in choosing their own strategy to solve a task. However, distributed schemes incur more communication overhead. The advantages is being motivated us to opt the work with multi-agent based systems.

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