Collaborative Knowledge Centralization Approach via Self Propagating Multi Agent Community Development (SESEME)

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Introduction

Most researchers in Artificial Intelligence to date, have dealt with developing theories, techniques, and systems to study and understand the behavior and reasoning properties of a single cognitive entity. AI has matured, and its' endeavors were capable of addressing more complex, realistic, and large-scale problems. Such problems are beyond the capabilities of an individual agent. The capacity of an intelligent agent is limited by its knowledge and its computing resources Sycara, 1998). Multi agent systems can be defined as loosely coupled networks of independent entities called agents, which have individual capabilities, knowledge and resources, and which interact to share their knowledge and resources, and to solve problems beyond their individual capabilities (Wikipedia, 2010). The issue of knowledge sharing has been an important topic in multi-agent research. SESEME will address most of the above mentioned limitations in this domain and the final deliverable will be an agent society which is capable of self-learning and training new agents. Agents' communication is one of the defining characteristics of a multi agent system. In traditional linguistic analysis, the communication is taken to have a certain form (syntax), to carry a certain meaning (semantics), and to be influenced by various circumstances of the communication.

SESEME can be differentiated from many other past efforts that have been carried on.

SESEME addresses the problem of self-learning by agent itself (Capable of taking the knowledge as it is and no human enrolment).
Efficient Methodology of Knowledge Representation using ontology and its own experience.
Introducing a new methodology of knowledge distribution and train other agents.
Instantiate new agents relevant to the domain.

The system starts its learning process once it receives a text document (in .doc, .pdf and .html formats) or even it receives an URL from the domain expert. First the system identifies the given content by using natural language processing and it ignores the ambiguity, complexity and the conflicts among the read content. The read content will be used to create or update its knowledge over the specified domain. The Centralized Self learning module (CESLM) is been facilitated with some additional features like adoption of existing ontology and domain experts feedbacks. Each sub agent consists of an ontology that represents its basic knowledge retrieved from CESLM and the system facilitates the updating of sub agent's knowledge

Methodology

SESEME consists of 5 main modules: Centralized self-learning module (CESLM), Agent development frame work, Knowledge acquisition framework, Inference refiner, Agent Training Frameworks

Cenralized self learning module (CESLM)

Centralized self learning module (CESLM) is a self-learning software agent which is capable of learning from natural language sources. CESLM is configured as the centralized component of the SESEME multi agent frame work and is developed using the model introduced with our previous research Semantic Self Learning and Teaching Agent (SESLATA) (Fuller, 2004).

Agent development framework

Agent development framework acts as an integrated GUI-based environment that facilitates instantiation of sub agents into the knowledge centralizing approach introduced with our research. Instantiated sub agents inherit the properties and behaviours of centralized agent and the framework handles the process of acquiring them into the subagents. It also supports the extraction of specific domain ontology from central ontology repository with minimum knowledge. The framework facilitates the updating of sub agent's knowledge through knowledge acquisition module. The system provides a built in ontology mapping tool which is implemented under the JADE development framework and it holds the capabilities of mapping xml/ RDF to OWL ontology in Onto_X Framework (Koggalahewa, 2010) .

Knowledge acquisition module

Knowledge acquisition module plays a two way communication role between the centralized agent and the instantiated or plugged in sub agents. This module is capable of analyzing the sub agent's domain knowledge by ensuring the availability, accuracy and strength of the knowledge

Inference refiner

Once the sub agent is been instantiated by the agent development framework it will acquire the basic domain ontology as well as the initial inference rules of the centralized agent. The system facilitates the domain experts to refine the sub agent's inference and change the behaviour of each agent according to the specified domain requirement.

Agent training framework

Sub agents are trained through the provided infrastructure of the system under two major areas.

Behavioural training

Encapsulates the basic initial behaviour predefined by the centralized agent module and the behavioural patterns are defined by the JADE framework. All sub agents are facilitated for training under a specific behaviour by considering its domain requirements.

Knowledge acquisition training

Initially the sub agent will inherit the basic domain ontology under the specified sub agent's domain.

Training framework is capable of analyzing the depth of sub agent's knowledge and performs necessary updating activities under the domain ontology. The module is guaranteed to update current knowledge as well as the supported ontology components

to the sub agent's knowledge, with multiple explanations and interactive learning sessions.

Research Findings:

Agent Instantiation Methodology

Ontology Mapping Service

Collaborative Knowledge Sharing System

Agent Training & Inference refining methodology

Distributed Agent Community

Conclusions

SESEME will step up to a new innovation of collaborative knowledge sharing machine community by introducing several solutions to the prevailing limitations of multi agent systems, Natural Language Processing, Artificial Intelligence Machine Learning, and Knowledge representation via ontology. SESEME is expected to grant an agent community which will learn, understand, train and propagate itself. It will usher a new era of mankind by introducing self-propagation of multi agent methodology, ontology mapping service, collaborative knowledge sharing system, agent training & inference refining methodology and distributed agent community. The concept will be applicable in most of the areas and it can be expanded over various domains such as robotics, medicine, business etc...

References

Sycara, K. P. 1998. Multi agent Systems, The American Association for Artificial Intelligence,

"Multi-agent_systems", [Online], Available: http://en.wikipedia.org/wiki/Multiagent system ,Accessed: 07 February 2010.

Fuller, S. Christoper Brewster and Kieron O'Hara 2004. Knowledge Representation with Ontologies :The Present and Future IEEE Intelligent Systems, 19 (1): 72 - 81

Koggalahewa, D. N., S.P.B. Athauda, S. U. Pilapitiya, O.A.R.K.Fonseka, D.T.K. Geeganage and J.L. Amararachchi Methodology of Knowledge Representation from Natural Language (Onto_X) 1st research symposium, Uva Wellassa University, Sri Lanka. September 2010.