A Knowledge Acquisition Model Using Multi-Agents for KaaS

Dhanashree Nansaheb Kharde, Justus Selwyn

Abstract—These days customer satisfaction plays vital role in any business. When customer searches for a product, significantly a junk of irrelevant information is what is given, leading to customer dissatisfaction. To provide exactly relevant information on the searched product, we are proposing a model of KaaS (Knowledge as a Service), which pre-processes the information using decision making paradigm using Multi-agents.

Information obtained from various sources is taken to derive knowledge and they are linked to Cloud to capture new idea. The main focus of this work is to acquire relevant information (knowledge) related to product, then convert this knowledge into a service for customer satisfaction and deploy on cloud.

For achieving these objectives we are have opted to use multi agents. They are communicating and interacting with each other, manipulate information, provide knowledge, to take decisions. The paper discusses about KaaS as an intelligent approach for Knowledge acquisition.

Keywords—Knowledge acquisition, multi-agents, intelligent user interface, ontology, intelligent agent.

I. INTRODUCTION

DATA growth is increasing day by day and the knowledge acquisition is done from these large corpora. It is a recently emerging topic in knowledge engineering domain. Data is divided into different type - structured, unstructured and semi-structure data. Process on structure and semi-structure database is bit easy when compared to manipulating unstructured data. From web source like internet, Google, Facebook, Gmail and different sites we get large corpora of unstructured data. So extracting knowledge from unstructured data is a challenging task. Many challenges address to make this approach more practical [1]. Learner is one of the systems that collect knowledge about everyday objects and events from volunteers. Intelligent acquisition interfaces for web volunteers have their own different challenges.

This paper is deals with a representation of design feature which gives effective interface for analyzing collected data. In this paper we present four design features:
1. Create template to acquire specific type of semantic relation between words.
2. From the type of answers provide guidance and feedback on query.
3. Breaking complex and large statement into several

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smaller statements.
4. Post process on data for repair or discard entries.

Intelligent acquisition interfaces face three main problems. 1) Ambiguity in natural language contributions, 2) describing a highly complex and interrelated world, and 3) detecting and handling spurious and non consensus contribution [1].

This paper motivates the design feature of intelligent acquisition interface. We opted to use multi-agents approach to design such an interface. Agent is an independent program which is capable to take action to meet an objective. Agents having different properties like autonomous, adaptive, mobility, flexible etc. Multi-agents allow multiple agents to co-exist, execute simultaneously, and allow communicate with each other. We are using different agents for different purposes. Agents like user interface agent, mining agent, domain ontology agent, query treatment agents, research information agent. For developing agent, JADE (Java Agent Development Environment) platform is used, which is a product of Sun Microsystems. Multi-agents systems have many benefits over normal system like reduce human work, faster problem solving, learning capabilities provide.

A. Related Works

Data is collected from different web sources. So, when collecting data and acquire knowledge from web there are two major factors mainly need to be taken care. They are:

1. Homogeneity Gap

The knowledge acquired from the web is nuanced and heterogeneous so it becomes difficult to use. If we want more usable then it should be homogenous and semantically interpretable [3].

2. Comprehension Gap

There is difference between system and human knowledge when we compared both. Humans have natural processing ability whereas knowledge systems have extremely limited ability to process natural language. This is a limitation for system.

If we combine homogeneity gap and comprehension gap, it gives rise to three new challenges.

There are different learner stages like learner 1.0, learner2, learner2.5 with adding new things like significant changes with new feature [6]. Also work on open mind common sense (OMCS) and use knowledge of learner [4]. Then analyze the current shortcoming of knowledge visualization. This is based on semantic distance, which calculates according to the user's interest and different importance of the concept in knowledge map. The advantage of this method is efficient for users to

explore the information and comprehend the knowledge implied in knowledge map [3]. This gives how to focus on users' interest.

The other related work is done based on ontology for semantic information research using agent. This work gives information about semantic relation and how agents work together. This work deals with a model whose objective is to improve the result towards a user information need. This will be done by acting on measure of recall and precision. To make intelligent system used multi agent system which reproduce the concept of autonomy and combine a syntactic search improved by the use of semantic that provides the word net ontology [2].

There is different work done on agent technology. Agents are used from different purpose like booking consignment for supply chain management [4]. The main objective of SCM is design a sub module named booking of consignment which increases flexibility in freight transport by interlinking organization and operating process. Approach based on the idea that a system is composed of decentralized in individual agent and that each agent interact with other agent according to its localized knowledge [7]. Another work done on acquisition method of knowledge element for emergency management system is found in [5]. In this formal description of knowledge element is given. Characteristics of emergency management knowledge are multi-field, multi-granularity, multi-dimensional and multi-disciplinary. The knowledge element acquisition method is combined with web 2.0 [8]. As far as we understand these are the related knowledge acquisition and agent technology works in the literature.

II. PROPOSED APPROACH

This section introduces four basic steps which investigate to cope with the challenges and the basic properties of agent technology.

A. Phases of Knowledge Acquisition

We have identified four features for Knowledge acquisition processes.

1) Phase 1: To Acquire Specific Type of Semantic Relation Create and Fine Tune Template

When we collect data from web that data is heavily relies on natural language and work on disambiguation dialogues which are necessary. To simplify the process of collecting knowledge is use pseudo templates. This is used to generate another statement by replacing terms in previously statement. Consider the statement: '*map contains information*'. This statement goes as forerunner for the new statement '*article contains information*' which allows knowledge collection process and is quite expressive. Using templates it's easy to acquire knowledge and fill in the template blanks, instead of entering full statements. Using templates focuses more on precise than language in its common usage and focus on acquiring specific type of knowledge. It works as slot filler.

Templates work on different relation. There are different types of relationship like '*part of relationship*', '*has a*

relationship', '*typical use of*' etc.

For a defined *entity1* and *entity2* the relationship is framed as:

A *<entity1>* has a part called *<entity2>*

There is link between entity1 and entity2 .With respective entity 1, entity2 get changes. It is used to make system more intelligent.

Example: A car has a part called airbag.
 Is for relationship-
A <action> is for _____.
Example: Riding a horse is for fun.
So here riding is action.

This is different template which is basically focused on direct entity. So it becomes easy to find out knowledge rather than focus on extra data.

2) Phase 2: Feedback and Guidance on Form and Type of the Answer Sought

In this feature, what can actually go into the blank that is left to the contributors' interpretation about this guidance and about type of answers provided. It is like providing extra additional guideline to user on the basis of common templates like 'something is not going to happen because_____'.
Let's take example,
1. Burning wood is not going to happen because its wet.
2. A car has a part called piston/airbag/break etc.

So, it is nothing but providing feedback about whether what they just contribute is in line with sought to collect or not. For every answer provided, feedback is given in the form of score added. So after generating feedback on contributed answer, it provides guidance for the next answer sought.

3) Phase 3: Breaking Complex Statement into Small Several Statements

If the given statement is large and complex then the statement is broken into small sentence so it will be easy to process. It is like divide and conquer method. Divide complex statement into small statements, process and then merge. So, it is more effective and easy to process as well as process in correct direction. For dividing purpose use conjunction word like or, and as well as etc. and another strategy is set particular word count.

4) Phase 4: Post Process on the Knowledge to Repair or Discard Entries

These approach uses for the correcting wrong words. So this interprets correct meaning. Post process includes different work like spelling check, missing value addition and discard entries etc. it is nothing but repairing the knowledge. It is a small step but which produce more impact. It is nothing but simply process on knowledge. These are different steps to acquire proper knowledge.

B. Agent Components

For adding intelligent approach we are merging multi-agent

technology. Agent is an independent program that is capable to take action in order to meet the objective [7]. Agents having different properties like autonomy, pro activeness, reactive, social ability, mobility etc. Agents have different name like robots, software agent, know bots, task bots, user bots etc.
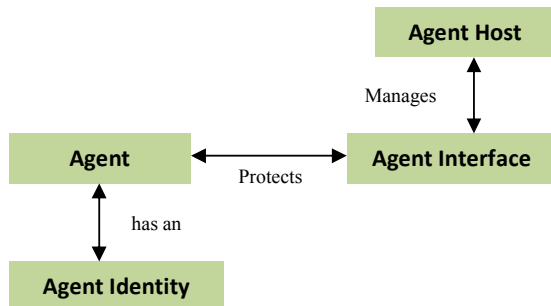

Fig. 1 Agent Architecture

Agent Host

Keep track of all the agents executing system. Interact with other agent hosts to transfer an agent from one system to other.

Agent

Agent (given program) executing on a given agent host.

Agent Interface

Provide access to well-defined interface, communicates with other agents. It is like platform that is also used to envelope an agent.

Agent Identity

Uniquely identifies an agent. This is for collaborating and communicating with interested agents. Agent naming cannot be used because it leads to ambiguity in identification.

III. METHODOLOGY

A. Architecture for Knowledge Acquisition

System architecture of a multi-agent based knowledge acquisition mainly divides into three units:-
1. Interface Unit
2. Management Unit
3. Research Unit

The functionality of each of these units are presented below in this subsection.

1) Interface Unit

This Unit has the user interface and the existing users or user groups. It provides interface to interact with external system. Also records the user request in terms of keywords.

User Interface Agent

The interfacing part from which query is entered in the system. Also they receive and transmit to the system the user feedback and present the research result. It is an intermediate part between the user and the system.

2) Management Unit

In management unit there are two parts which include domain ontology and query treatment agent. It is related to the processing part. Query treatment agent coordinates the activity of the system. It prepares the query to be submitted to information research unit, and after processing returns the final answer to the user interface agent.
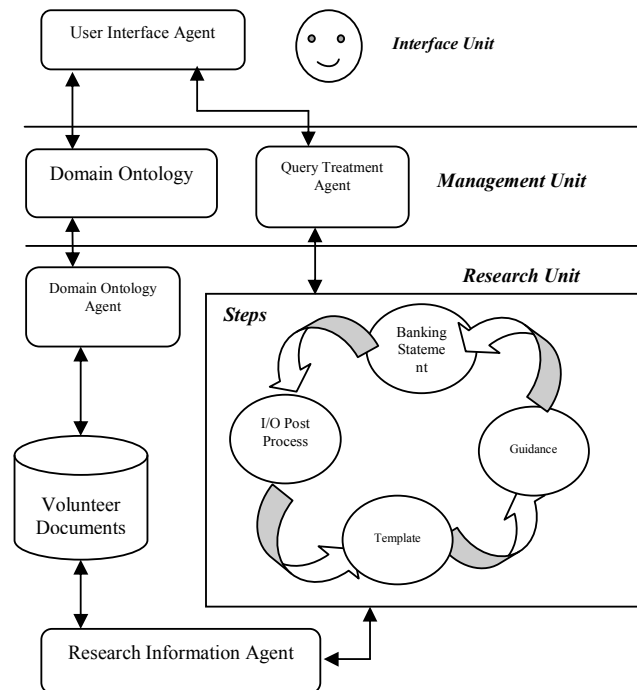

Fig. 2 System Architecture of Multi-Agent based Knowledge Acquisition

Domain Ontology

It is the collection of the areas of interest of relevant information related to the query. The query treatment engine processes the query and maps with the related, specific domain so that relevant results are given to the user interface agent.

Query Treatment Agent

Query treatment agent manages cooperative execution of user request knowledge; ontology based knowledge, and interacts with other agents to achieve a common goal.

3) Research Unit

This unit contains the domain ontology agent, volunteer document, and four stepped process module.

Domain Ontology Agent

This agent is used for inspecting and monitoring the dynamic changes in the information resources content. It executes the query from the instance of specified ontology and stores the results in a document link.

Process Module

This module is related to processing of four steps which we

already discussed. These four steps are assigned to different agents. They work together and give the final answer to the research information agent.

Research Information Agent

This agent contains processed answers or results from the process module. This provides the related, specific, interested and required end-user's output.

A. JADE Working Platform

1) Different Agent Running on the Jade platform

As shown in Fig. 2, Knowledge Acquisition processes are covered by four agents: Interface agent, Domain ontology agent, Query Treatment Agent and Research information agent, that are continuously interacting and communicating with each other. Processing an input file from the interface agent and classifying them based on the domain and creating ontology, then acting according to the external query requires all the agents run independently. Fig. 3 shows the how simple agent runs on JADE platform.

2) Sniffing in Different Agent on Same Server

This shows how communication is done between different agents, and how we can monitor the communication of agents. We have brought the agents on the same server and created a virtual remote location and monitored how the agents communicated. This shows that agents in remote locations can also contribute to the knowledge acquisition processes.

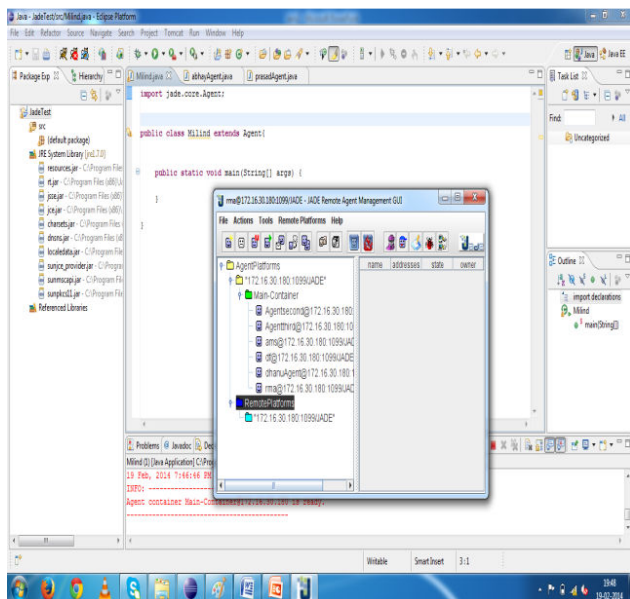Fig. 4 shows these processes in detail.

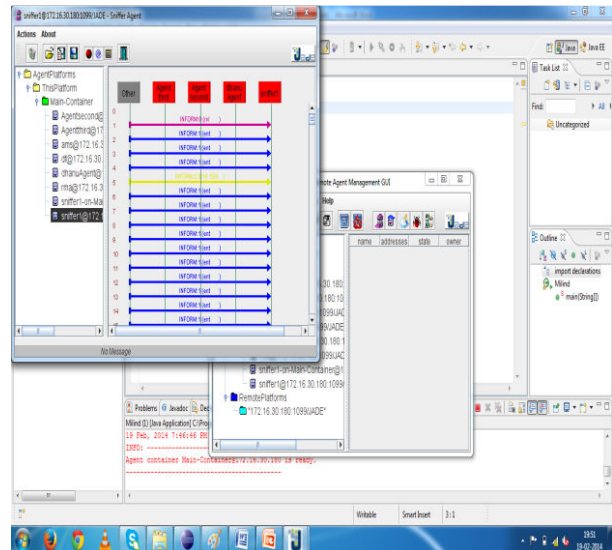Fig. 3 Different Agents running on JADE platform

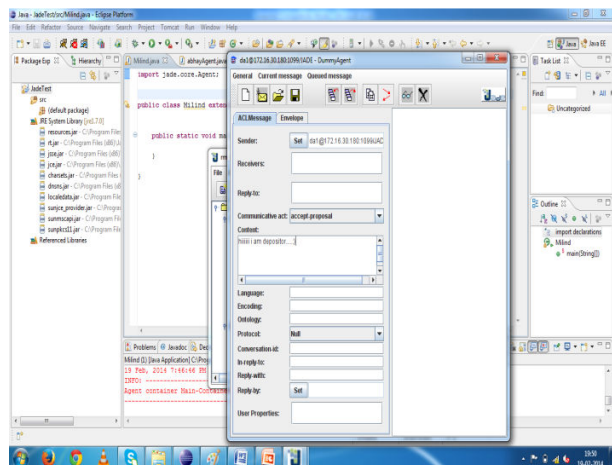

Fig. 4 Communications between Agents

Fig. 5 Sending messages to other Agents

3) Sending Message to Other Agents

It shows how the message is sent to other agents. While this is done now manually, and tested for correctness in communication, the agents will communicate as and when there is a need for it. This should be made programmatically to have efficient way of communications amount agents. Fig 5 shows the message part sending messages to other live Agents.

IV. CONCLUSION

In this paper we have proposed a new approach for acquisition of knowledge using agent technology. The proposed architecture is simple, which means, we have divided the acquisition processes into different agents and made them communicate to achieve the objective. Finding knowledge related entity in the repository and then converting into a service as per customer's requirements and satisfaction,

is the ultimatum of this work. However the work is in its initial stage, and will improve to address several other issues.

As future work there is more scope for improvement in the proposed system with respect to the correctness of the acquired knowledge, and the consistency in acquiring knowledge from the web. We have given only four agents to acquisition of knowledge but there is still scope for adding new other agents to improve and scale up the system to acquire accurate knowledge from unstructured repositories which ultimately makes the system more flexible and intelligent.

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