MULTI AGENT BASED ARCHITECTURE WITH ARGUMENTATION FOR PATTERN RECOGNITION

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Abstract

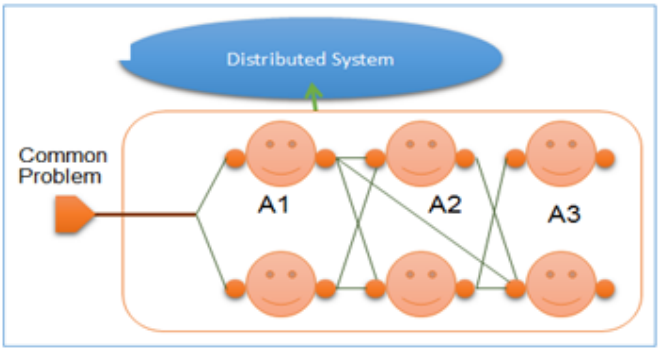
This paper presents model of multi agent systems based on argumentation for pattern recognition. Defines a very simple description of coordination and negotiation schemes through multi agent systems. We also introduce the concept of pattern recognition with multi agent system using argumentation and modification in blackboard architecture. We are going to explain what argumentation, pattern recognition and blackboard architecture is. Finally, we briefly describe how agents can recognize symbols using argumentation.

Keywords: Argumentation framework. Pattern recognition. Multi agent system.

1. Introduction

Argumentation is major component in human intelligence. For successful communication they must understand each language and during the communication they must use arguments to solve problems. In multi agent system to find one solution we are using argumentation framework. When agents communicate they are not using same vocabulary and ontology, if they want to interact successfully they should use arguments and find correspondences between the terms they are using in their ontology [1].

This article describes what is argumentation framework and pattern recognition, how they are connected and why we need arguments in pattern recognition, can we create multi agent system (Figure 1) for pattern recognition without argumentation framework, how to interact agents and implement argumentation framework in multi agent systems [2].



Successful communication is main problem in the architecture where are working many agents for one solution. Every agent must know each language, they should support or refuse another candidate logic and each of them must use same vocabulary to express its beliefs and they must transfer information between agents. Each agent must respect another candidate opinion and consider during the decision making. In this paper we are planning to create argument based communication framework in multi agent based architecture for pattern recognition. Our goal is to interact many agents and they should find one solution for one problem. For decision making we decide to use framework that allows agents to express their preferred choices over candidate's correspondence. This is achieved adapting argument-based negotiation used in multi agent systems to deal specifically with arguments that support or oppose the proposed correspondences between ontologies.

2. Argumentation in Pattern Recognition

What is pattern recognition? Pattern recognition is the study how agents can observe environment and make decision about categories of the pattern. The best pattern recognizers are

humans, but we still can't understand how they can recognize patterns. It will be very helpful if computer will help doctors and diagnose diseases or help drivers to drive car. Automatic (machine, computer) recognition means classifying, grouping and at the end get exactly result of object. There are two types of recognition 1) Supervised recognition when the pattern is identified as a member of predefined class. 2) Unsupervised recognition when the pattern is identified as a member of undefined class.

Human's brain consist off billion of neurons and using this neurons he/she can recognize patterns. Whenever we meets a person and this person is known for us we can recognize his/her name, surname, how we are doing this, we are performing task of recognition. Suppose we are asking to computer to do this task, how much time conventional computer need to do this. It is not easy computation for computer, firstly we know this person but computer do not. We must study this to computer and it is not easy.

What is argumentation? Argumentation theory is an important field of Artificial Intelligence. In multi agent environment where agents try to purpose their own goals, cooperation cannot be taken for granted. To reach agreements and negotiation between self-motivated agents we should use argumentation framework. The purpose of argumentation is to resolve a conflict between agent's opinions. Argumentation framework has a big impact in multi agent environment.

We also can extend argumentation framework, namely, Value- based Argumentation Framework (VAF). The VAF allows determining which arguments are acceptable, with respect to the different audiences represented by different agents. Our agents apply different approaches and cooperate in order to exchange their local result (arguments).

An argumentation framework is a pair AF= (AR, attacks), where AR is a set of arguments and attacks is a binary relation of AR. An attack (A, B) means that the argument A attacks the argument B. A set of arguments S attacks an argument B if B is attacked by an argument in S. The key question about the framework is whether a given argument A, A □ AR, should be accepted. One reasonable view is that an argument should be accepted only if every attack on it is by an acceptable argument (Dung, 1995) [1].

3. Multi Agent Recognition Architecture

As we know Pattern recognition is branch of Artificial intelligence as Sound Recognition or Hand Writing Recognition but Argumentation Framework helps agents for making decision in multi agent architecture. In Pattern recognition system with multi agent based architecture to make one decision, to communicate many agents, to study agents how to respect another agent's opinion we should use Argumentation Framework. Below in this article we are going to explain blackboard architecture (model) and then extend it, we will try to explain what is blackboard model , how it works and how we can to implement it also we are going to show some examples using blackboard model and step by step define what our agent must do [4,5]

A blackboard system is an artificial intelligence application based on the black-board architectural model, where a common knowledge base, the "blackboard", is iteratively updated by a diverse group of specialist knowledge sources, starting with a problem specification and ending with a solution. Each knowledge source updates the blackboard with a partial solution when its internal constraints match the blackboard state. In this way, the specialists work together

to solve the problem. The blackboard model was originally designed as a way to handle complex, ill-defined problems, where the solution is the sum of its parts.

The blackboard architecture is a powerful expert system architecture and model of cooperative, distributed problem solving (Many agents are working for one solution). The basic blackboard architecture consist of a shared data region called as blackboard, which is a set of knowledge sources and control units, also called the scheduler.

The main advantage that a blackboard system can offer are its flexible of control and its ability to integrate different kind of knowledge sources. A blackboard system consist of three of components (Figure 2).

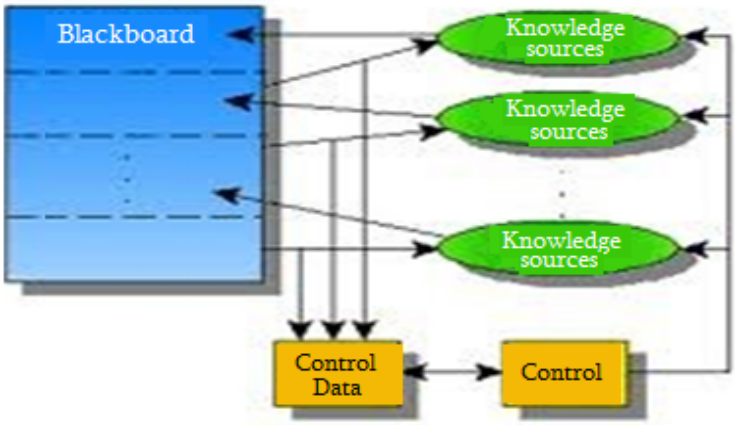


Fig.2. Blackboard (BB), Knowledge sources (KSs) and Control unit

BB - a shared data structure through which the knowledge sources communicate with each other by means of the creation and modification of solution elements;

KSs - a set of independent modules called knowledge sources, which have specific knowledge about the problem domain;

Control - a control mechanism, which determines the order in which the knowledge sources will operate on the blackboard.

4. How Blackboard architecture works and our modifications in this architecture

Accomplish blackboard architecture consist of three component and each has own role to solve problem. Every agent makes own modification and task moves another position, after this other agent makes its own modification and etc. This process continues before we do not have exact solution. To decide which agent should make modification at this moment controls Control Unit. If task is on the position where agents cannot make modification, it goes to the previous position.

What is modification which we decided to make in blackboard architecture? We decided to add argumentation framework in blackboard architecture. Every agent which makes modification on the blackboard has an appropriate argument. This argument we need to know why agent made modification on blackboard and if another agent has counterargument for this argument they are starting discussion or arguing about modification and finally they has one decision.

Hence, before every agent makes modification on the blackboard, they must prove modification which they are going to make and after this they are making changes. Below of this article we are going to show an example how to solve problems using blackboard modified architecture, how are making modifications on the blackboard and how we are going to find exact solution.

5. Symbol recognition using multi agent system with argumentation

Accomplish in this section we are going to show how are agents working to recognize symbols. We are going to detail explain what each agent does for recognition and its goal. Each agent has its own knowledge and using this they should try to recognize symbols. We have master and slave agents and master agents knowledge is more than slave agents and master agents has more privileges then slaves.

Imagine we have agents and they know how to recognize: arc, point, rectangle, corner, fork, cross, hole, oval, triangle and etc. (Figure 3)

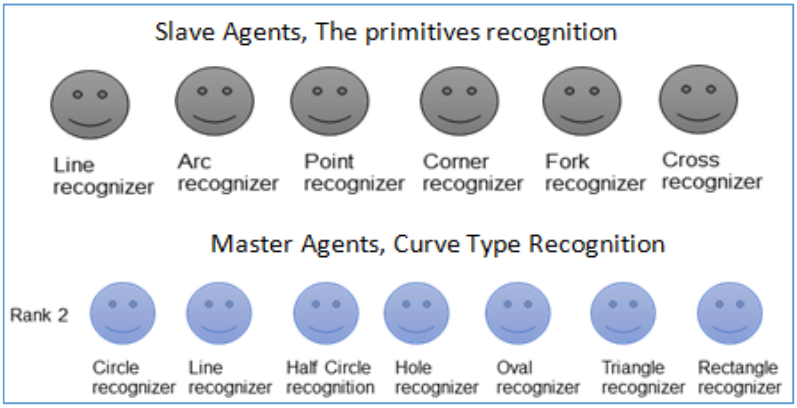


Fig.3

On the figure 3 shown that every agent has its knowledge and what they can recognize. Let's start to explain how they can recognize symbol „X".

1. Line(x),Line(y), Cross(x,y) --> Symbol (z) {Name(z,"x")} - rank 1
2. Line(x),Line(y), Cross(x,y), Not Vertical(x) --> Symbol (z) {Name(z,"x")} - rank 2

Rank 1 agent says that if there is two lines and they are crossing each other this symbol is 'X', after this rank 2 agent says if there is two lines and they are crossing and also they are **not vertical** this symbol is 'X'. Rank 2 agents have more priority to make decision then rank 1 agent.

6. Conclusion

A simplistic approach for recognition of visual characters using multi agent system has been described. The advantages of multi agent system over classical methods have been outlined. In this article we was trying to explain how multi agent architecture with argumentation works, what is preferences of this architecture and how we can use it. We were talking what are multi agent systems and what is argumentation. Also we made modification in blackboard architecture. How can work agents using blackboard architecture with argumentation. In this article everyone can see clearly preferences of multi agent system with argumentation. Also explained symbol recognition example and detailed explained how agents can recognize symbols.

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სახეთა გამოცნობისთვის მრავალ აგენტებზე დაფუძნებული არქიტექტურა არგუმენტაციით

ზურაბ ბოსიკაშვილი, გიორგი არჩვაძე
საქართველოს ტექნიკური უნივერსიტეტი

რეზიუმე

წარმოდგენილია მრავალ აგენტიანი სისტემების მოდელი, დაფუძნებული არგუმენტაციაზე ობიექტების ამოცნობის მიზნით. განსაზღვრილია მარტივი კოორდინაციის და მოლაპარაკების სქემა მრავალ აგენტიან სისტემებში. მოყვანილია ობიექტების ამოცნობის ძირითადი ცნებები მრავალი აგენტის და არგუმენტაციის გამოყენებით, ასევე შეტანილია ცვლილებები შავი დაფის არქიტექტურაში. განსაზღრულია არგუმენტაციის სქემა შავი დაფის არქიტექტურაში მონაწილე აგენტებისთვის ობიექტების ამოცნობის პროცესში. შემუშავებული მეთოდიკის საფუძველზე განხილულია სიმბოლოების ამოცნობის ამოცანა.

МУЛЬТИАГЕНТНАЯ АРХИТЕКТУРА С АРГУМЕНТАЦИЕЙ ДЛЯ РАСПОЗНАВАНИЯ ОБРАЗОВ

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Резюме

Представлены мультиагентные модели на основе системы рассуждения для идентификации объектов. Определена простая схема координации и соглассования во мультиагентных системах. Предстовленны основные понятия идентификации объектов, использующие систему мультиагентов и рассуждения, также внесены изменения в архитектуре черной доски. В процесе распознавания объектов разработанна схема аргументацый для агентов, участвующих в архитектуре черной доски. На основе разработонных методов обсужденна задача распознавания символов.