RICAD: TOWARDS AN ARCHITECTURE FOR RECOGNIZING AUTHOR'S TARGETS

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Abstract: We present RICAD system based on a semi-automatic method from specific-domain corpus (with which it is impossible to apply classical method information research). This approach is based on a model of intentional structure and RICAD system to recognize the author's intentions from written documents in a specific domain. Our RICAD system happens in three stage: 1) to make a segmentation in a semi-automatic way of a document according to the authors intentions, and to extract the intentional verbs accompanied by their concepts of each segment through the system algorithms, 2) ontology building and 3) This system is also able to update the ontology of intentions for the enrichment of the knowledge base containing all possible intentions of a domain.

1 INTRODUCTION

The masses of information the researcher is exposed to make it hard for her to find the needle in the haystack as it is impossible to skim-read even a portion of the potentially relevant material. The information access and search problem is particularly acute for researchers in interdisciplinary subject areas like computational linguistics or cognitive science, as they must in principle be aware of articles in a whole range of neighboring fields, such as computer science, theoretical linguistics, psychology, philosophy and formal logic.

In this article, we tackle the problems of representation of information contained in documents by basing us on the various structures which can be extracted from it. Several types of structures can be identified and used to describe information and to facilitate research and the restitution. The structures most fluently approached in documentary information, according to the type of concerned document , cover with supplementary aspects: physical structure (related to the restitution), logical structure (generally hierarchical organization of the various elements composing a document), semantic structure (semantic decomposition of a document), rhetoric structure (is a descriptive and functional theory of the textual organization based on the recognition of semantic relations between units of text), spatio-temporal structure (representation in space and time). Exploitation of the logical and physical structure has an interest already proven with an aim of facilitating fragmentation, storage and restitution of documents. However, the documents structures based on rhetoric, semantics and in particular the communication intention are neither yet sufficiently studied, nor exploited in the documentary systems. Our work is focused more precisely on the concept of intentional structure. This concept represents intentional knowledge of the textual corpus. This intentional knowledge could be used as a basis for any process of annotation or of retrieval documents because they will make it possible to bring supplementary information on the contents of these documents. By basing on the theory of the intentionality, we developed an RICAD whose objective is to find the communication intentions of the authors. This RICAD uses techniques existent natural techniques of deduction, close to those used by an expert domain. Its specificity in the fact that it is able to find the author intentions, to refine its strategies of analysis of a new corpus and to produce ontology of the intentions automatically. The research and the identification of the intentions are based on a segmentation of texts, then the analysis of each segment to extract the intentional verbs and

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their associated concepts. The used techniques of segmentations and the methods of extraction and analysis of the intentional verbs are described in this paper.

This article is organized by follow: section 2 gives an overview about research in plan recognition. After the overview, we present the recognition systems based on the intention (section 3). Finally, conclusion and future work are presented in Section 4.

2 RELATED WORK (OVERVIEW)

Since Schmidt(Schmidt et al.,78) first identified plan recognition as a problem in its own right, plan recognition has been applied widely to a variety of domains, including natural language understanding and generation (Allen et al., 80) (Carberry, 90), story understanding (Wilensky, 78) (Charniak et al., 89, 93), multi-agent coordination (Huber et al, 94), dynamic traffic monitoring (Pynadath et al., 95), collaborative systems (Ferguson et al., 96, 98), adventure game (Albrecht et al., 98), network intrusion detection (Geib et al., 01), multi-agent team monitoring (Kaminka et al., 02), and so on.

Many plan recognition approaches have been proposed. (Kautz et al., 86) presented the first formal theory of plan recognition, using McCarthy's circumscription. They define plan recognition problem as identifying a minimal set of top-level actions sufficient to explain the observed actions, and use minimal covering set as a principle for disambiguation. To deal with uncertainty inherently in plan inference, (Charniak et al., 89, 93) built the first probabilistic model of plan recognition based on Bayesian reasoning. Their system supports automatically generation of a belief network (BN) from observed actions according to some network construction rules. The constructed belief network is then used for understanding a character's actions in a story. (Huber et al., 94) used PRS as a general language for plan specification. They gave the dynamic mapping from PRS specification to belief networks, and applied the approach to coordinate multi-agent team.

Pynadath and Wellman proposed a probabilistic method that was based on parsing. Their approach employs probabilistic state-dependent grammars (PSDGs) to represent an agent's plan generation process. The PSDG representation, together with inference algorithms supports efficient answering of restricted plan recognition queries. More recently, Bui et al., 02, 03) proposed an online probabilistic policy recognition method based on the abstract hidden Markov model (AHMM) and the extension of AHMM allowing for policies with memories (AHMEM). In their frameworks, scalability in policy recognition in the models is achieved by using an approximate inference scheme (i.e., Rao-Black wellised Particle Filter). Besides Bayesian models, some probabilistic approaches are based on Dempster-Shafer theory, e.g., (Carberry, 90) and (Bauer, 95, 96).

Though the approaches differ, most plan recognition systems infer a hypothesized plan based on observed actions. World states and in particular, state desirability (typically represented as utilities of states) are rarely considered in the recognition. On the other hand, in many real-world applications, utilities of different outcomes are already known (Blythe, 99). A planning agent usually takes into account that actions may have different outcomes, and some outcomes are more desirable than the others. Therefore, when an agent makes decisions and acts on the world, the agent needs to balance between different possible outcomes in order to maximize the expected utility of overall goal attainment. Utility and rationality issues have been explored in earlier

Work in AI (e.g., rational assumptions, (Doyle, 92)). Plan recognition can be viewed as inferring the decision making strategy of the observed agent. So it is natural to assume that a rational agent will adopt a plan that maximizes the expected utility. While current probabilistic approaches capture the fact of how well the observed actions support a hypothesized plan, the missing part is the utility computation.

One measure of progress in information retrieval many systems has been developed, i.e. which adapts to the circumstances of the information recognition process.

In this paper, we present the architecture of our RICAD system to recognize intentional structure from scientific specific-domain.

In the following section, we present the several systems by taking into account the concept of intention recognition.

3 INTENTIONAL RETRIEVAL SYSTEMS

An intentional retrieval systems were developed by our research team, these system are: SABRE system (Al-Tawki et al., 02) is an Authoring system Based on the Re-use, who allows helping the authors to create new documents based on fragments of existing documents. These fragments are described in terms of the intentions of their authors, and are identified by the main intention of their author, The XSEdit system «XML Shared Editor ", is a system consists to conceiving and implements a tool of distributed co-operative edition allowing managing and controlling the intentions of the writers by metadata (Tazi et al., 06a, 06b). It utilizes techniques whose employment extends quickly currently and is based on a portable language. This tool should make it possible to the users to compile and annotate the same document without having to be located at the same room, and at the same moment. This tool has more interest if the users not are at the same place., and finally the Pero system (Elhore et al., 06), and RICAD System (Kanso et al. 07), the first system is used the learning by observation through the reasoning of intentions and the second one, the RICAD System is to recognize the author's intentions from written documents in a specific domain.

These Tow following section, shows how the Pero system recognizes the intention of an action executed and the RICAD system recognizes the authors intentions from written scientific documents.

3.1 Pero System

The ***Pero*** system was developed with an aim of implementing a model of problem solving based on the concept of intention (Elhore et al., 05a, 05b, 05c, 05d, 06). This model consist of a planner who allows to solve mathematical problems applied to the physical sciences by generating an explanation related to each stage and which leads to the resolution. The model proposes to integrate the notion of intention in the process of problem solving in order to add knowledge of explanation resolution. This concept represents knowledge which leads to the realization of each resolution action i.e. the means and the reason used to take the action as well as the explanatory argument. The graph of resolution in which the nodes correspond to the states of the planner and the arcs with the actions of resolution makes it possible to represent the explanations (Figure 1) as being the goal, the means and the justification of resolution on the level of each arc of the graph.

This section shows how the Pero system recognizes the intention of an action executed. This recognition eases the explanation process of the solving exercises.

We will adopt the following generic form to represent an intention in the process of the scientific problem solving: IA (a1, a2, A, G, M, R)

Where IA represents the intention belonging to I could be carried out by action A. This expression expresses that the agent a1 with intention I to carry out action A, to try to achieve the goal G, by the means M for reason R. a2 represents the agent which is intended the action, it is generally learning it. Where

a1: is the author of the action; it is generally the system,

a2: is the agent for which is intended the explanation of the action; generally is the learning,

G: (Goal) is an act which expresses what the author wants to make by making the action;

M: (Means) is an act which expresses the type of action achieved on the reasoning;

R: (Reason) is an act which expresses with which concepts the author makes the action.

This model we propose here takes into account the context of actions being performed. Each action achieved by the planner is contextualized, i.e. we consider what one may call the intention of the action. The intention of an operator of the planner is a set of knowledge representing the goal of the action, the means used to perform the action and the reasons that justify the action. This knowledge depends on the context of the action, so for any action performed to solve a problem, there is an intention that could be considered as the explanation of this contextual action. The whole explanation of the solution is considered as the set of explanations of the actions performed to attain the final solution. In previous work (Tazi, 2001) we have developed the model of Intentional structures that we recall briefly here.

Pero generates the knowledge concerning the description of what we call the intention of the action, (i.e. the goal, the means and the reasons for the action). This knowledge comes from the solution graph. The whole explanation destined for the student is the concatenation of the all intentions of the actions belonging to the path solution.

In order to illustrate this model, the following is a draft of how the solution is proved and the explanation is generated.

Let EQ1 be the initial state, and EQ2 be the final state. (EQ1 and EQ2 are respectively the first equations that will lead to the second equation after a certain number of substitutions and or calculus).

When the system passes from one state S1 to the following one (S2) it concatenates the intention of the action that leads from S1 to S2.

1. Goal: try all possible combination of substitution and calculus to find the solution
2. Means: are the operators used in the actions;
3. Reason: is the set of theorems, laws or functions that triggers the operator.

For each action the intention is defined as:

1. Goal: Try to find the final state from the current state
2. Means: The operators used to perform the action (e.g. Substitute, Calculate, Derive, etc.)
3. Reason: justify the action by the arguments that trigger the action, these arguments can be theorems, laws, lemma functions, etc.

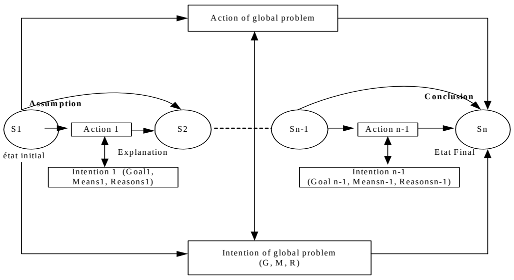

Figure 1: Explanation process with intention recognition.

In the following section we present our RICAD system and different stages of intention research.

3.2 RICAD System

The RICAD is dedicated in the information research of textual corpus (Figure 2). It is based on algorithms which facilitates the intentions research and its principle of operation closer to domain expert. At the beginning, after we make manual text segmentation, it calls some tools such as: **Treetagger**, for extracting the verbs for each segment, **Wordnet** to find the synonyms of the verbs which belong to the same segment in order to minimize the set of verbs, a knowledge base containing the intentions in order to find out the intentional verbs of this segment.

The RICAD system allows also adopting a method of counting the intentional verbs to find the occurrences of each verb in order to announce the intention of each segment. It has also the possibility of generating intentions ontology of documents containing all possible intentions.

The RICAD system is based on the following steps. The i*nitialization,* this task which set up the necessary resources to all other following operations. It is the first task being launched and is carried out only before starting the other tasks. Initialization in the RICAD system, allow us to introduce a corpus annotated by an expert, and to enrich the knowledge base containing the verbs, and their relative and absolute frequencies and their intentions.

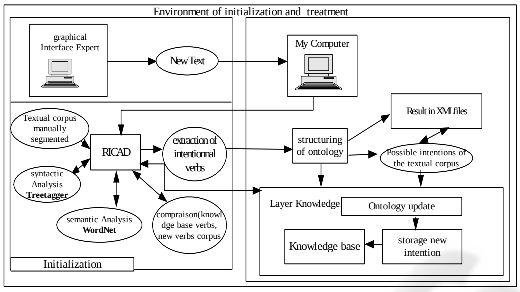

Figure 2: RICAD Architecture.

The *Introduction of a new corpus,* this stage makes it possible to the reader to introduce a new corpus not segmented, and used it like the entry of the system, in order to make an analysis to segment it according to the authors intentions. *Syntactic Analysis (Treetagger)* allows the system to make a syntactic analysis on each logic element of the document. The RICAD recognizes the sentences and the verbs using the ontology of the verbs. The *Semantic Analysis (Wordnet)* after the generation of the textual files which contain lists of the verbs, the semantic analysis uses Wordnet to find the synonyms of the verbs in the annotated corpus in the same segment in order to avoid the redundancy of the verbs, and at the same time to find the other synonyms of these verbs. The *Comparison (Knowledge Base verb, new corpus verb)* will be made according to most relevant frequencies of these verbs in the knowledge base and that of the verbs of a new document (which is an estimation of the verbs probability that repeat in the knowledge base with big frequencies). In this stage we obtained segmentation by sentences, and we used then the principle of regrouping sentences by intentions. For that, all the contiguous sentences which have verbs at the same intentions are regrouped at the same segment. *The Result on XML files,* this stage allows the generation of an XML file containing the results of segmentation accompanied by intentions.

When the RICAD system find a new terms (verbs or concepts) from collections of scientific documents not included in our knowledge base, it will be added and updated automatically the existing knowledge base. These changes may then be incorporated into the RICAD knowledge base.

4 CONCLUSIONS

This article presented some related work and several systems were developed by our research team based on the concept of intention. We used existing structures in order to restructure the collections to solve arising problems of information research within these collections. We based on the concept of intentional structure to establish a semi-automatic system of segmentation according to the author's intentions.

We present some of our research into the development of tools for analyzing scientific and problem solving in the natural language processing and extracting intentional information, and the different relationships between local and global intentions.

Ontologies are used with a knowledge representation language for the machine and are exploited with possibilities of inference.

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