Computer System for Deductive Issue from Natural Language Text through Interpretation in Semantic Resolution

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Abstract **- A system for Deductive Issue from Natural Language text written in English language is presented in the paper. The system solves some linguistics tasks in the logic area, through H- interpretation under Universal set U. An appropriate semantic type is chosen for the H-interpretation. As results from series known facts, the program gives an answer of the question if a given statement is false or true.**

Strings of statements are presented as a deductive system of knowledge used as initial data. The rules of predicate logic and principle resolution are applied.

The objective is to find an empty disjunct from the system. The programming language for the system is Delphi.

Key words: propositional calculus, logics, disjunctive system, semantic resolution, logical issue.

I. INTRODUCTION

The system presented in this work is a deductive model of decision making system. The problem to be solved is written as a formal deductive system. We confirm or refute the problem by using some axioms and the rules for issues from formal logics.

Decision making system models are mechanisms for management of complex objects. It is impossible to describe the models using only mathematical instruments. The objects themselves in that system evolve in the time, change their structures and functions. This leads to evolution of the management process itself. The goals of objects' management cannot be always expressed as a quantitative correlation. Logics – linguistics management models are applied for building such systems. A typical characteristic for retrieval of the used knowledge in the objective area is the availability of some logical tools. The knowledge is presented in a linguistic form.

The ideas developed in this work could be applied to management systems. An example is the operative-dispatcher management of power supply board system, sea and river ports, etc. One of the directions for increasing the dispatcher management's affectivity is creating a system for transferring information, incoming from the dispatcher to a computer.

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II. ERBRAN'S PROCEDURE OF ISSUE. SEMANTIC RESOLUTION

The analysis and algorithms of this system are based upon the Erbran's procedure of issue based on the following theorem:

Theorem 1 A given set of disjuncts S is executive if and only if it takes value false in all interpretations in all areas of interpretation.

Due to the impossibility to examine all interpretations in all areas it is necessary to find a special area of interpretation. If S is impracticable in this area, then it will be impracticable in the other areas of interpretations [1]. Such area exists and it is called Universum of Erbran. The definition is the following:

Theorem 2 Let H_0 is a set of constants, appearing in the set of disujncts S.

- If there is not a constant in S, then an arbitrary constant "a" is included in H_0. т. е. H_0 = {a};

- For i=0, 1, 2 … H_{i+1} = $H_i \cup \{ f^n(t_1,t_2,...,t_n) \}$, where f^n is a n – positioned functional symbols, which occur in S a $t_1,t_{2,...,}t_n$ are elements of sets H_i. Then H= H_∞ named Universum na Erbran, for S , a H_i - its level i.

An effective modification of the principle of resolution is the semantic resolution. The cancels of disujncts which are tautologies and gluing of disjuncts going through the process of issue completely only slightly decrease the number of unduly disjuncts. Some cardinal ways are necessary to generate only significant disjuncts. The interpretation of predicate letters appears as a tool for generation of disjuncts.

III. SYSTEM DESCRIPTION

Entrance data

The program accepts at the entrance a file containing a logical task. A dialogue window appears on the screen through which the appropriate file must be chosen. The base format of the files for working the program is Special text *.stf, but it is possible to import text files *txt as well. In this away we can introduce a logical task using external text editor.

By using of a built text editor in application keyboard symbols are accepted to be introduced according to the Latin letters and punctuation signs. Mouse movements on the

windows of the applications and keyboards combinations of symbols corresponding to commands implementing in the program induced the program at the entrance as well.

Exiting data

On the screen the exit of the program displays a path of the decision and the result. The condition of the solving problem, the path of the decision and its result are printing on the text document.

As an option writing in a file is suggested of the edited logical task. The basic format used for keeping information is Special text *.stf, but it is given a possibility to export in a text file *txt as well. It allows the editing of the logical task text to be done by an exterior for the program text editor(Figure 1).

Description of the data flows

- Execute user's command - the process holds the choice of the user from the basic menu of the program and starts the other process carrying out the request.
- ***File manager*** - the process forms the text of the introduced by the user task as a text format (txt), keeps it in a text file or reads from a text file written in advanced text and supplies it in the text field of the program.
- ***Parse text*** - the process makes the text parse of the introduced by the user task. It defines the different logical facts and presents the text as formulas.
- ***Teach the program*** - the process is starting when it meets an unknown to the program word and requires from the user to define its type as a part of the speech.
- ***Resolution*** - the process transforms the described by logical formulas user's task in a disjunctive normal form. Then it applies the rule of the resolution to deny the goal (resolution refutation) and gives the result to the process show results.
- ***Show results*** - the process visualizes on the screen the path of the decision and its result. The text of the task, the decision path and the result can be printed by request of the user.
- ***Dialog*** - the process realizes the dialog with the user by giving a message on the screen and showing the possible answers.

We make the entering of the text of the logical task by text field in the frame of the main windows. The entered restrictions and spelling rules are observed. The goal we have to prove is entered in the last sentence.

IV. RESTRICTIONS

The text of the logical task, that the system has to solve, is entered only in English language. The relevant syntactic and logical rules are respected.

The using of the following type of sentences is allowed:

- simple sentences not containing conjunctions

Example: P → John works.

- Compound sentences including only one coordinative conjunction

Example: P&Q → John works and John smiles.

PVQ → John works or John smiles.

- Complex sentences with a conditional subordinate in any of the two parts of which there is either a simple or a compound coordinative sentence

Example: P&Q → R -If John works and John smiles then John is a boy.

P ↔ Q V R- John is a boy if and only if John smiles or John works.

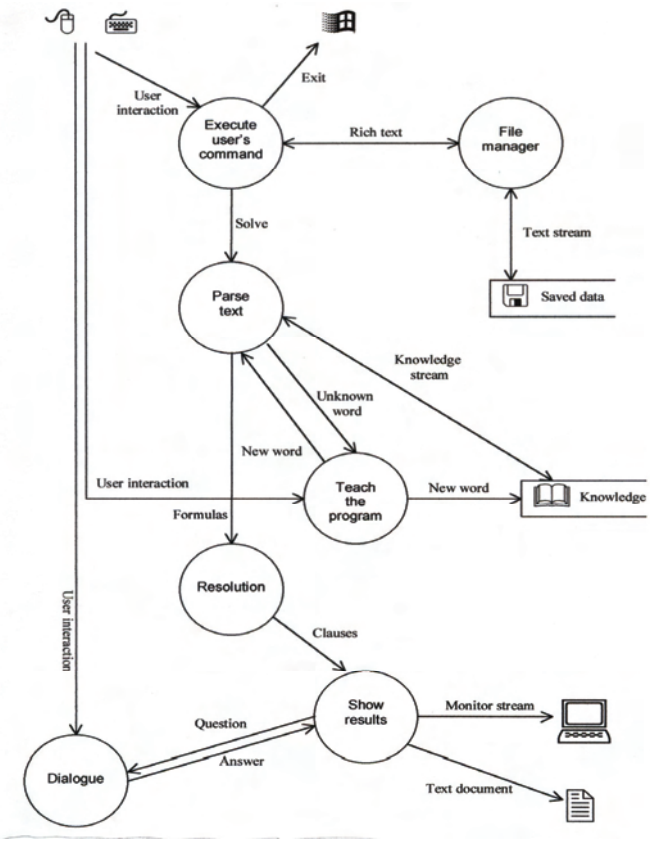

Figure 1 Diagram of the data flows and the processes in the program

Data streams and processes in the program

If a negative sentence is introduced the negation has to be written separately from the secondary or the modal verb.
Example: John does not work. John can not work.
The use of personal or possessive pronouns is not recommended. If the program text includes them
but yet, the definition of the action subject is needed.

Text example

Text of the logical task
John awakens. John brings a mop.
Mother is delighted if John awakens and cleans his room.
Ij John brings a mop then he clean his room.
Goal: Mother is delighted.

Meaning facts:
A - John awake
B - John brings a mop
C – John cleans John's room

D - Mother is delight

Path of the decision

(1)	pA	
(2)	pB	
(3)	nA*nC*pD	
(4)	nB*pC	
(5)	nD	
(6)	nA*nC	(5), (3)
(7)	nA*nB	(6), (4)
(8)	nC	(6), (1)
(9)	nA	(7), (2)
(10)	nB	(7), (1)
(11)	nil	(9), (1)

Decision results:

It is true that: “Mother is delighted.”

V. Conclusions and results

A system for deductive issue in a semantic resolution is realized from a text, written in natural language. The system could be used as a decision making system or as an expert system.

Explicit type logical tasks in logic and mathematical linguistic area can be solved effectively by using the system. In this sense the system can be used successfully as a learning system .

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