On Meanings of Words, Sentences and Texts Interpreted for Chess and Literary Eastern Armenian

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ABSTRACT
In this paper we present our developments, approaches and ideas addressing them to the solution of the problem of the semantic analysis of the text. The paper shows our understanding of the meaning of the word "meaning" as a "value" and as a "goal." The first hypostasis is used to determine the "zero" level meaning of the sentence, and the second – for the meanings of "higher" levels. Also are given the methods used by us to solve the problem of homonyms – identifying the "right" value of the given homonym in the given sentence. There are listed algorithms and fuzzy mathematical methods developed to determine the meanings of "higher" levels.

Keywords
Semantic analysis of the text, homonym analysis, disambiguation, fuzzy approaches

1. INTRODUCTION

The problem of the semantic analysis of the text is still one of the main unsolved problems of artificial intelligence. To solve this problem, many research groups have tried. They used a variety of approaches [1, 2]. However, there are no "sufficiently" good results yet. Recently – at the end of 2014, ABBYY has presented software that pretends to do a semantic translation. So far we do not know the work of this product[1].

In this paper, we try to present our development, approaches and thoughts in thementioned direction of artificial intelligence. First of all, we raised the question: "Whether we imagine the problemquite clearly?" And "Whether we imagine the meaning of the word "meaning"enough clear?"

It turned out that these are fundamental questions, from the answers to which depends the right direction of further discussion. And so, we accept the following understanding of the meaning of the word "meaning":

Definition: The meaning of the word "meaning" is expressed in two concepts:

1. Value,
2. Purpose
   2.1. Benefit,
   2.2. Reason.

We must say that we are not alone – are not original, in our approach to the understanding of the meaning of the word[2].

But as far as we know, in the semantic analysis of the text, the second hypostasis of the sense –purposehas no practical application.

Since it is believed that chess is a "fly Drosophila" of the artificial intelligence [4, 5], first we conducted a model study, considering the chess notation as a text, and attempted to identify the meaning of such kind ofatext.

2. THE CHESS NOTATION AS A TEXT

In chess notation the half-move[3] is a complete analog of common text because a half-movecan be read and it contains the main parts of the sentence – predicate, subject, as well as additions (objects). Therefore, we can apply the traditional steps of text analysis (in this case –asentence):

1. Lexical analysis of the sentence (= the half-move)
2. Syntactic analysis of the sentence (= the half-move)
3. Semantic analysis of the sentence (= the half-move).
   3.1. Detection ofthe half-move'smeaning as a value
   3.2. Detection of the half-move'smeaningas a goal,

Detection of the half-move'smeaning-goalis the resultant from the meaning of position.

Definition: Under the *meaning of position* in chess we understand extracting the maximum possible benefit from this position, in other words, *the meaning of the position is to obtain a new position (a local target), the assessment of which will be maximum* [4, 9]

Example: Here is a full analysis of the half-move Kg1-f3. As a result of the lexical and syntactic analysis of the sentence (= the half-move) we get the following picture:

- K (knight) (subject)
- - (goes) (predicate)
- g1and f3 (adverbial modifier of place).

All known by us text processors (including UNL) would stop considering that as the meaning of the sentence (= the

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[1]http://www.youtube.com/watch?v=HPlV9mzqeFQ Introducing ABBYY

[2] The Dictionary Explanatory (RU-RU) gives a following explanation: "1.Internal, logical content (word, speech, phenomena) cognized by intellect; *meaning*. 2. Intellectualbasis, *purpose*, benefit, *profit*, favor, use, gain. (underlined by us)" [3]

GSE in the article "Meaning" particularly write: "In the linguistics – sometimes it is the synonym for *significance* but usually it opposed to him and could mean:

- A set of non-linguistic characters of the content, in contrast to the meaning as the generalization of its intralinguistical characters,
- A semantic character of a whole statement or a text, in contrast to the meaning (at the level of a separate word)[3].

[3]The half -move refers to the move done only by one side of the game.

half-move) is detected [6]. *But is the obtained result sufficient for understanding the meaning of the half-movefrom point of view of chess game*? The answer is obvious –*no*! No, because the chess notation is a symbolic-word description of the events taking place on the chessboard.

And for the reader of chess notation is non-less (and probably much more) important the answer to the question: "*What is the purpose for Knightto be repositioned from the field g1on the field f3*?", than the fact of statementof the half-move. The answer to this question lies in the true meaning of chess sentence(= the half-move). The answer to this question is not just highly dependent on the concrete position, in which was made the half-movebutis determined by the meaning of position itself and is aimed at the implementation of the meaning (= goal) of position.

As follows from the definition, the meaning of position is very subjective and depends on the personal characteristics of chess player – the author of chess notation (= text), first of all on thequalification ofthe chess player.

So for us, the result of parsing is the beginning of definition of the *zero level meaning*. That is to us from this begins the semantics, while for others with this it ends. In the case of the analysis of chess notation it may be effectively introduced the concept of the meaning of the first, second, etc. levels according to the depth of position analysis byone, two, etc. moves. To identify the meanings of the half-moveof a non-zero level it is necessary to have – to develop the base of chess expertise knowledge represented in the way as they are perceived and operates with them a chess player-human.

Let's define the zero level meaning of considered half-move (=sentence). Chess notation is made on a strictly formalized language. However, the reading of the text can be up to a certain arbitrary action as a person operates the words of a natural language, and the latter is rather ambiguous. Thus the half-move Kg1-f3 can be read - voiced by the following ways: "*The knight goes off from thefield g1 (rearranged, moves, jumps, becomes, and so on ...) to the field f3»*.

We have the different values of the symbol (= chess word) "-" of the Russian (Soviet) chess notation, each of which involves some meaning and/or emotional tone in the interpretation of the half-move. For example, the word "jump" reflects the specificity of the move of this chess figure to pass through obstacles on its way from the initial field to the targetfield, and the word "becomes" highlights the fact that the knight is assigned to the field f3. But the fact is that a particular interpretation of the meaning of the half-move gives the reader or commenter of the considered game, and the question is to determine the meaning which is laid in the sentence (= the half-move) by the author of the text (chess notation). In this regard, the basis of our approach is our understanding of the "*meaning of the sentence*."

Definition: *Themeaning of the sentence*refers to a certain invariant during synonymous paraphrasing of the sentence.

Similar positions onthisissuetakes I.Mel'čukand his followers. [1, 7]The question is how to define – to identify, this invariant?

Postulate: The main part of a sentence is the predicate[4].

From this postulate, it follows that the basic zero level meaning carries the predicate of the sentence. And it suggests that the invariance should be linked with synonyms of the predicate.

Postulate: Invariant of the verbal synonyms is the most abstract – a generalized, representation of the action expressed by these verbs.

A generalizing word for the given synonyms is a word – *moved*.[5]

So, the zero level meaning to the half-move Kg1-f3 can be formulated as follows: "*Theknight moves from the field g1 on the field f3»*.

3. NATURAL LANGUAGE TEXT

The same principle is also at the basis of determining the meaning of a sentence in a natural language.

- The meaning of words is determined by the lexical analysis in the context of syntax.
- The zero level meaning of the sentence is determined byparsing in the context of semantics.
- The meaning of sentence of much higher level isdetermined by the local context and its meaning, that is, the local goal that sets the author of the text in the given completefragment of the text.

3.1 The meaning of the word

The text for us is a chainof symbols used to write to a text file of correct expressions in Eastern Armenian literary language.

3.1.1 Lexical analysis

Definition: The *word* refers to the text a sub-chain bounded

- <u>from the left</u> by one of the following characters:
  - a space, a dash, a symbol of the beginning of the line, open parenthesis, opening quote, slash;
  - <u>fromthe right</u> by one of the following characters:
  - aspace, a hyphen, newline, closing bracket, the closing quotation mark, slash;
  - one of the punctuation of the Armenian language:
  - comma, period, colon, dot;
  - one of the marks of pronunciation:
    - bottles ("՝"), question mark ("՞") and space, elongation mark ("՜") and space, accent mark ("՛") and space;
    - From the combination of one of the last three marksand any letter of the Armenian alphabet skip the mark and the word is considered without it.

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[3]Although we have independently put forward this postulate, however, in fairness, it should be said that firstlyit was published by a French linguist Lucien Tenière L. [8], becoming the founder of the "dependency grammars".

[4]Appears a problem: how to automatically receive and load the base of knowledge a generalized word for each group of synonyms?

We have developed an algorithm to identify the uncertain form of the word, based on the Armenianmorphology. It consists of the following items:

- Isolation of the end part of the word,
- Determinationof the end type of the word:
  - Verbal end (for example: «-ացի» in the word գնացի, «-եցրեց» in the wordաճեցրեց, etc.)
  - Nominal end (for example: «-ով» in the words գլխարկով, մեծով, «-ից» in the wordգրպանից, etc.)
    - Accounting – special processing of endings from the intersection of these two sets (for example: «-ում» in the word գնում)
- Verbal endings are replaced by the corresponding end terminations of indefinite forms and the resulting word is looked up in the dictionary. (For example: «-ացի» in the word գնացիis replaced by «-ալ» and turns toգնալ, «-եցրեց» in the word աճեցրեց–to the «-եցնել» to give the word աճեցնել etc.)
- Identification of cases of nominalized parts of speech
  - Resolution of homonymcase situations (e.g.: Casesուղղական/հայցական, սեռական/տրական)
- Defining the parameters of verb conjugation (person, time, date)
- Recording and analysis of homonyms:
  - Homonyms «ես» (auxiliary verb in sentences such as «Դուեսգնացել:» and the personal pronoun in sentences like «Եսգնացելեմ:»), «արի» (the adjective "courageous", the conjugation form oftheverb «գալ», interjection in the expression «Արիգնանք»)
  - Homonyms ending with «-ում», «-ու», «-ի» (գնում (in price, the purchase, conjugation formof the verbsգնել and գնալ), գնալու (գնալուեմ and գնալուհամար), պարի (declined form of the noun պար and conjugation form of the verb պարել)
  - When one of the meanings of homonym is a verb, and the other one is another part of speech (e.g.: այրի as a nounwidow, and as a form of conjugation of the verb այրել– burn, մեխեր– nails and conjugationformof the verb to nail down, etc.) it always is possible to make out on the basis of syntax,
  - in other cases (for example: մկան as "muscle" and as a genitive case of the word մուկ– ”mouse") are often able to make out on the basis of syntax,
  - In the third case (for example: the word «մատ» as a chess term "mate" and as "finger") is necessary to resort to the context.

  In the latter case, from the point of view of language they are not distinguishable. Differences occur at higher levels of analysis.
- Consideration of phraseology and set expressions (e.g.: «ցույցտալ», «գլխիրնկնել», etc.)
- Consideration of various kinds of exceptions related to:
  - definition of the words in the plural (for example: «կանայք–կին», «փշեր–փուշ», «դռներ–դուռ», «նվերներ–նվեր», «զարդեր - զարդ», etc.)
  - definition of conjugation forms of irregular verbs (for example: «գալ», «տալ», «լալ» «եկավ - գալ», «տվեց - տալ», «միլար - լալ», etc.)
  - definition of declensional forms of the name parts of speech (for example: «քրոջ - քույր», «շան - շուն», «իմ - ես», «բարու - բարի», etc.)
  - andsoon ...
- Identification of the words denoting the pot of the person.
- Identification of the words denoting the name and / or surname of the person.
- Identification of lexical dictionary supplies, which suggests:
  - Creating an electronic dictionary (automatically).
  - Inputting knowledge to the dictionary (automatically).

3.2 The (zero level) meaning of a sentence

In order tocarry out a syntactic analysis we made an important and very awkward decision: before the beginning of the parsing,we split a complex sentence into simple ones. This was done in order to greatly facilitate further parsing. It is based on consideration of the following postulate:

Postulate: In every simple sentence it can be only one predicate (apparent or presumptive).

This predicate can be simple or complex, but the number of such predicates should not be more than one.

3.2.1 Parsing(syntactic analysis)

So, the parsing algorithm consists of the following items:

- A breakdown of complex sentences into simple ones:
  - Compound sentences are broken down and arranged in the order of simple sentences (e.g.: Արամնրնկավջուրը, կոշիկներըթրջեցուգնացտուն:)
  - Complexsentences
    - Determination of the main (sentence) . It is located on the first place
    - All subordinate sentencesare located in the order to be followed.
- Identification of predicate ineach of the simple sentence.
- Identification of a complex combination of subjects (the number may vary from 0, 1 and more, depending on what number is the predicate) in each simple sentence
  - Application of syntactic knowledge (coordination with the predicate by the person and the number) to candidates for the subject (e.g.: «Դասերիցհետոերկարօրյայումաշակերտները (subject) տնայինաշխատանքնենսովորաբարկատարում:»)
  - Application of knowledge (semantics) to the candidates for the subject (e.g.: «Քարնըրնկավջուրը:»)
  - Identification of enumerations– candidates for the subject
    - Defining priority among subjects for grammaticalagreement with the predicate in the person and number.
  - Identification ofenumerations – candidates for direct additions
  - Identification enumerations in the enumeration (eg: «Այստարվաձմեռայինցրտաշունչեւձնառատօրե

րինես, Արամըեւնրաբարձրահասակ, գեղեցիկ, շիկահերհյուրըգնացելէինքԾաղկաձոր:»)

- Insertion ofdropped (for aesthetic reasons) members (subjects and predicates) of simple sentences, isolated from complex sentences.

Forexample: compound sentence «Արամնընկավջուրը, կոշիկներըթրջեցուգնացտուն:» is broken into simple sentences, and alleged subjects are being inserted as follows: «Արամնընկավջուրը:», «[Արամը] կոշիկներըթրջեց:», «ու [Արամը] գնացտուն:». But the sentence «Արամըգնացտուն, իսկմենք՝թատրոն:» is broken and supplemented as follows: «Արամըգնացտուն:», «իսկմենք (,) [գնացինք] թատրոն:». It generates the word «գնացինք» from the predicate word «գնաց» →«գնալ»→«գնացինք» keeping tenseof existing predicate and in agreement of inserted onewith the number and person of the subject of target sentence.).

- Identification of additions (objects) ofsubject (subjects) based on syntactic and semantic knowledges.
- Identification of additions to predicate: the modifiers of place, time, etc. based on syntactic and semantic knowledges.

3.2.2 Semantic analysis

By semantic analysis, we understand the revelation of the zero level meaning of the sentence and subsequent non-zero levels in the context of the meaning of the whole text or local (to a certain extent completed) parts.

Like chess notation reflects events on the chessboard, and the text natural language reflects the real or imagined events in the real or imaginary world. Therefore, to identify the non-zero level meaning of the sentence we must have information about the context in which the events described. The question is how *to determine the context of the text itself, with no a priori information about the text?*

The chess situation closest to the described problem is a notation of chess problems and challenges, wherein the beginning by special notation is giventhe considered position.

In the case of natural language, we have developed or are in the process of developing the algorithms directed to:

- Automatic identification of groups (sets) of verbal synonyms of the same value;
- Automatic attribution of values of fuzzy relationship "similarities" on the sets of verbal synonyms of the same value;
- Automatic identification of the fuzzyproperties of fuzzy relations (fuzzy reflexivity, fuzzy symmetry, fuzzy transitivity, etc.) on the set of verbal synonyms of the same value;
- Automatic detection of generalizing words remaining invariant for sets of verbal synonyms;
- Automatic identification of semantically synonymous phrases (e.g.: «սեղանդնել» = «սեղանգցել» = «սեղանբացել» and etc.);
- Automatic detection and analysis of those sentences, the meaning (= purpose) of which is the description of the local context.

4. CONCLUSIONS

1. To determine the word meaning it is sufficient to reveal the direct sense that the author had in mind, using this word (the resolution of homonyms).
   An algorithm is developed and implemented that solves this problem automatically.
2. To determine the zero level meaning of the sentence it is sufficient to define the word expressing predicative action in a sentence pronounced in the most abstract form.
   An algorithm is developed for solving this problem automatically.
3. To determine the higher level meanings of the sentence it is necessary:

3.1. To get the zero level meanings of all sentences of a certain completed fragment of the text.
   An algorithm that solves this problem automatically is developed and implemented.

3.2. To identify the context from the analyzed sentences.
   An algorithm is developed for solving this problem automatically.

3.3. From the same fragment to isolate and analyze sentences, specifying the description of the situation.
   An algorithm is developed for solving this problem automatically.

3.4. Determining the type of the situation.

3.5. Definition of characters involved in the situation.

3.6. Definition of assessment of situation according to the type of situation for each character.

3.7. And in keeping with the objectives of each character a definition of the actions assessment of these characters.
   The last four points yet to be realized

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