Methods of extension of abilities of text models’ semantic analysis

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Abstract
Methods of extension of abilities of semantic analysis of text models by introduction of additional semantic parameters, which come out of basic semantic parameters are researched. The structural components of models are reviewed and they are a base on which methods of extension of abilities of text models analysis are researched. Basing on use of structural components of text models external semantic parameters are introduced, which also extend abilities of analysis of those models.

Introduction
Text model (TMi) describes object which is hard or impossible to be described by formal means of existing mathematical theories. This is caused by fact that relevant means require from object such level of its abstract representation that the last one is so distorted, that loses key features, determining its nature. As such objects are proposed social objects (SOi), which represent separate population groups. Models, used in that case are text descriptions of relevant SOi in normalized form, which have definite structure and are implemented on selected natural language of user. Obviously TMi must be used to solve tasks, related to SOi. To some of those tasks are related the following ones: task of control of objects of SOi by external controlling factors, task of interaction of TMi and respectively SOi, with each other, task of detection of information about state of SOi and transmission of such information to external factors, task of organization of new SOi from separate SOi, etc.

All introduced above tasks can be implemented only in case if there is some controlling factor. Such controlling factor in that case can be text information stream (IPi), formed on language used for description of TMi. It is known that any action on one or another object should at least lead to temporary or permanent change in relevant object. In case of action of IPi on TMi, such change is in extension of TMi by text from IPi, which can be coordinated or not coordinated with TMi. In first case can take place controlling action of IPi on TMi, which is implemented immediately. In second case controlling action will be implemented basing on use of a number of coordinating transformations. Factors which create IPi can be other TMi, or some abstract sources of IPi, structure of which from the point of view of this research will be ignored.

Methods of implementation of controlling actions on models
Let’s review in details mechanisms, implementing controlling actions on TMi basing on preset IPi. Controlling action must be characterized by some targets, tightly related to TMi, as a controlling object. Such targets can be following effects of action of IPi on TMi: change of state of TMi, activation of TMi relatively to other TMi, activation of output of data about current state of TMi.

The simplest action of some IPi on SOi and, respectively, on TMi can be an action, aimed on change of current state of relative SOi and TMi.
At the level of external representation, formally such action can be described by correlation in which we will operate models $TM_i$ and $IP_j$: 

$$(IP_i \rightarrow TM_i) \rightarrow ([IP_i \cup TM_i] = TM_i^*)$$

Change of state of $TM_i$ as a result of action of $IP_j$ on $TM_i$ is implemented by semantic synthesis of text, which is located in $IP_i$, and text, which describe $SO_i$ and is represented as model $TM_i$. Synthesis of two text objects, formed according to grammar rules of selected natural language must consider syntax of relevant grammar which we will mark $\Gamma(M_i)$, syntax rules, defined in $\Gamma(M_i)$ we will mark as $\gamma_i$. As it is known, grammars of most of languages are based on some classification of separate words, which define their grammar types [1]. Syntax rules define allowed methods of mutual location of words of different type during forming of separate phrase $\phi$. Types of separate words are defined basing on corresponding dictionaries, containing description of their interpretation. So, we can assert that classes of words, or their types are determined only basing on semantic interpretation and by grammar rules $\gamma_i(x_1,\ldots,x_n)$, where $x_i$ – separate word. For conduction of more complete analysis of text descriptions in which can be detected some peculiarities and details, characterizing relevant $SO_i$, it is necessary to introduce not only semantic parameters but also methods of determination of their numeric values. Basing on use of such concepts we can implement not only qualitative analysis of text descriptions but also their numerical analysis which significantly extend relevant analytical possibilities. Such approaches are recently [2, 3]. According to information about such parameters we can place among them: semantic value of separate words ($\sigma^S$), semantic controversy, determined at least by two words or two phrases ($\sigma^K$), semantic conflict, determined in framework of limitations for $\sigma^K$ ($\sigma^K$), semantic superfluity ($\sigma^H$), semantic insufficiency ($\sigma^D$).

Presented above semantic parameters can have some numeric values, determined basing on usage of numeric values of basic semantic parameter $\sigma^S$ could be definition, basing on data, presented in [4].

Definition 1. Amount of semantic value $\sigma^S$ is determined by frequency of relative word $x_i$ being used in text descriptions, which are $TM_i$, and describe some subject area.

In case of use of such method of determination of $\sigma^S(x_i)$, the last during process of functioning of some system $STM_i[TM_1,\ldots,TM_n]$, which correspond to $W_i$, can change. As $\sigma^S(x_i)$ can change with time, then it is necessary to implement some period of functioning of whole system $STM_i[TM_1,\ldots,TM_n]$, to which belongs current set of text models. Such period we can suppose to be equal to $\Delta T_i$ and it will be determined by set of changes in $STM_i$, which are functionally bind with each other. Value $\sigma^S$ is determined basing on following correlation:

$$\sigma^S(x_i) = \alpha \left\{ \forall x_i \in [W_i = [TM_1,\ldots,TM_n]] \sum_{j=1}^{m} \delta(x_j) \right\}$$

where: $x_i$ – word or other separate semantic entity for which is determined semantic value, $\delta(x_i)$ – delta function equal to 1, if $x_i$ takes place in relevant element. Sum placed in denominator determines general number of different $x_i$ which are located in $S_C$ and are presented there once. Sum, placed in numerator determines number of cases of usage of $x_i$ in $TM_i$, which in interval $\Delta T_i$ form system $STM_i[TM_1,\ldots,TM_n]$. So, $\sigma^S(x_i)$ takes value in range, first point of which is 0, when numerator is equal to zero and it means that $x_i$ is in $S_C$ and is not used in $STM_i[TM_1,\ldots,TM_n]$. Following special point of the range is equal to 1, which means that $x_i$ is used in $STM_i[TM_1,\ldots,TM_n]$ as frequent, as number of different elements in $S_C$. Theoretically, after $\sigma^S(x_i) = 1$ value $\sigma^S(x_i)$ can grow to infinity, but transition of $\sigma^S(x_i)$ over 1 means that in $STM_i[TM_1,\ldots,TM_n]$ can appear anomaly. So, we can write down: $\sigma^S(x_i) \in [0,1,\infty]$.

Value of derivative semantic parameters, which are $\sigma^S$, $\sigma^K$, $\sigma^H$ and $\sigma^D$, is determined in different works taking into account peculiarities, researched in those works. Generally, $\sigma^S$ is determined as absolute value of difference between two neighbor $x_i$ and $x_i$ semantic values. Value $\sigma^K$ is determined as amount of closeness of semantic values $x_i$ and $x_i$, which in some extent is semantic extension for $\sigma^S$. Values $\sigma^N$ and $\sigma^D$ are derivative from $\sigma^S$ and $\sigma^K$, as the last ones can be determined only starting.
from phrases $\phi_i$ and $\phi_j$, if are they semantically personalized, or are not separate elements in $S_C$. It is obvious that $\sigma^N$ and $\sigma^D$ can be determined between separate sentences $\psi_i$ and $\psi_j$. At quality level, $\sigma^N(\phi_i, \phi_j)$ means that $\phi_i$ and $\phi_j$ have equal medium amounts of semantic value or takes place $s\sigma^N(\phi_i) = s\sigma^N(\phi_j)$ and functions, describing change of value $\sigma^N(\phi_i)$ and $\sigma^N(\phi_j)$ are equal. Semantic in-adequacy, in framework of this work, has more specific interpretation. For convenience, we will call semantic parameters $\sigma^N$ and $\sigma^K$ as first derivative semantic parameters and parameters $\sigma^K$ and $\sigma^K$, we will call second derivative semantic parameters. Semantic inadequacy $\sigma^D$ between two phrases $\phi_i$ and $\phi_j$ will take place in case when is performed following correlation:

$$\sigma^D(\phi_i, \phi_j) = \left[ \sigma^N(\phi_i) = \sigma^K(\phi_j) \right] \& [\sigma^N(\phi_j) = \sigma^K(\phi_i)]$$

Calculation of value $\sigma^D(\phi_i, \phi_j)$ requires more strict definition of value boundaries for $\sigma^N(\phi_i)$ and $\sigma^K(\phi_j)$. Definition of those boundaries requires direct interpretation of corresponding values, which is closely related to tasks, for solving which is used $\sigma^N$ and $\sigma^K$. 

Coming out of fact, that $TM_i$ is itself a text representation of information in normalized form, which describes relative $SO_i$ in part connected to tasks of control of $SO_o$, then control information must represent itself also text form in normalized view, which contains description of those changes relative to characteristics of relevant $SO_i$. Obviously different text streams have different control action or different control efficiency. Such efficiency, depending on content of text stream $IP_i$ and character of description of control information are determined in boundaries, one of which determines negative influence of $IP_i$ on $SO_o$, which is reflected in changes in $SO_o$, which amplify resistance to relevant control actions up to the boundary, determining complete acceptance of relevant action by $SO_i$. Obviously such changes are reflected in relevant text descriptions of models $TM_i$, which describe relevant $SO_i$. In that case, lower boundary we will determine by such situation, $IP_i$ does not lead to any changes in $SO_o$. In framework of such approach, control action of $IP_i$ is guided on real $SO_o$ object, but is reviewed in framework of its influence on model $TM_i$. One of main theses or suppositions basing on which are formed models like $TM_i$ is as follows. Mechanism of perception of $mt_i$, or other information by separate persons which form some social object $SO_o$ and forming general reaction $SO_i$ on information, which came into $SO_i$ is made basing on analysis of semantics, reflected in text description of relevant $IP_i$. If we use concept about semantic parameters, which characterize relevant texts and in one or another way reflect semantics of such text, then we can say that value of meaning of somehow determined semantics of texts in general and text describing $TM_i$, from one side and text, which must lead to changes in objects from other side which is located in $IP_i$, can be correlated and then there will be no controlled changes in $SO_i$. If semantic parameters which characterize $IP_i$ and relevant $TM_i$, which describe $SO_o$, have preset level of incoherence on all or separate parameters, then such incoherence can lead to changes in semantics of relevant text description $TM_i$, which can reflect change of position relative to one or another factor of physically present object $SO_i$ in general and also relevant changes of positions of separate members, forming relevant object $SO_i$. Physically or psychologically it is reflected in making one or another decision on relevant changes by each member of $SO_i$ and changing decisions in framework of whole $SO_i$. Modeling analysis of information, received by $SO_i$ from $IP_i$, is, in framework of this work, in analysis and calculation of values of semantic parameters of $TM_i$, which they took after adding to relevant $TM_i$ of text information from $IP_i$. So, accepting or not accepting one or another change in characteristics, describing $SO_i$ as $TM_i$, is determined by dependencies between semantic parameters in $TM_i$ and received additional texts from $IP_i$. Qualitatively described possibility is based on following provisions.

**Provision 1.** Semantics of text descriptions reflect physical nature of relations between separate person and community $SO_i$ to factors, reflected in framework of $TM_i$ as text on natural language of consumer.

**Provision 2.** To conduct analysis it is necessary to be able to characterize relevant parameters by different numeric values, principles of determination of which would be common for all components, included in to analysis.

**Provision 3.** Text descriptions $TM_i$ and $IP_i$ must have common subject area in framework of which we can review processes, characterizing their dependencies and such subject area must be described on such level of formalization, which is used for description of text models $TM_i$ and information streams $IP_i$.

To increase efficiency of analysis of texts in $TM_i$, it is necessary to characterize they functionally by wider set of semantic parameters comparing to mentioned above which reflect mostly semantic.
relations or semantic links between elements of $TM_i$, in framework of the model or in framework of $IP_i$.

Let’s accept that subject area independent of if it can change or evolve, is itself a basic system of semantic relations and is a base for determination of numeric values of semantic parameters for all $TM_i$ which are formed and function basing on relevant description of subject area $W_i(PO)$. Let’s accept that $W_i(PO)$ during analysis of interacting $TM_i$ and information streams $IP_i$, is not changed and is static. Mentioned above semantic parameters we will call a group of internal parameters, used only for researching semantic relations inside models or information streams.

To group of external parameters we will bring parameters, describing semantic relations between elements of separate objects like $TM_i$ and $IP_i$ and elements of description of subject area $W_i(PO)$, in framework of which are researched systems of models $TM_i$ and $IP_i$. Group of external semantic parameters is marked as $\pi$ with relevant upper index. Example of minimal set of such parameters could be parameters, analogical to parameters from group $\sigma$, to which we will bring: semantic inconsistency, $(\pi^7)$, semantic conflict, $(\pi^6)$, semantic excessiveness $(\pi^8)$, semantic insufficiency $(\pi^9)$.

On demand, range of semantic parameters of groups $\sigma$ and $\pi$ will be extended. Before we review qualitative description of semantic parameters of group $\pi$, we need to review forms of representation or formal description of subject area $W_i(PO)$. Main component, used to describe set of elements $W_i(PO)$ is semantic dictionary $S_C$ [5]. There can be used a variety of such dictionaries and each of them has its own specifics.

Obviously, bringing separate word to one or another group or class is based on interpretation of those words, which is generally accepted for all languages as words mean one or another entity of some objective reality according to different alphabets, used in relevant languages. Formally, such dictionaries are described as following correlations:

$$S_C^i = x_i = \{a_{i1}, \ldots, a_{im}\}^{p_{i1}, \ldots, p_{in}}$$

$$x_m = \{a_{m1}, \ldots, a_{mk}\}^{p_{m1}, \ldots, p_{mn}}$$

where $x_i$ – identifier, which is itself a word, used to mark some entity from $W_i(PO)$, described as normalized text on selected language, $a_i$ – word, which is itself an element of description of text interpretation, describing semantics of word identifier $x_i$, $p_j$ – numeric value of parameter, used for description of word $x_j$. Obviously, in framework of $S_C$ must be used following limitations.

**Limitation 1.** In text description of interpretation of word $x_i$ cannot be used word $x_{ij}$, which formally is described by correlation:

$$\forall (x_i \in S_C) [x_i : \{\alpha_{i1}, \ldots, \alpha_{im}\}] \rightarrow x_i \notin \{\alpha_{i1}, \ldots, \alpha_{im}\}$$

**Limitation 2.** If in $S_C$ for $x_i$ and $x_j$ takes place correlation $i < j$, then $x_i$ cannot be included into text interpretational description of word $x_i$.

Formally, this limitation is described by following correlation:

$$\forall (x_i, x_j) (i < j) \rightarrow [x_j \notin j(x_i)]$$

where $j(x_i)$ – is shortened markup of text interpretational description of word $x_n$, which is formally described as:

$$j(x_i) = x_i : \{\alpha_{i1}, \ldots, \alpha_{im}\}^{p_{i1}, \ldots, p_{im}}$$

Obviously, those limitations don’t deal with numbers $p_{ij}$ as they in framework of $j(x_i)$ cannot be used without relevant $\alpha_i$, which is supplemented in fact by relevant $p_{ij}$, if this is required by attached to $\alpha_i$ semantics.

**Limitation 3.** Each type $S_C^i$, in framework of system of description of subject area $W_i(PO)$ has some priority, determined by semantics, basing on which is extracted relevant group or class of words.

On quality level this means that the highest priority can have semantic dictionary, describing subjects, or $S_C^IP$, following level priority has semantic dictionary, describing verbs $S_C^ID$ and so on. Priorities can be set independent of interpretation of classes of words in some language.

**Methods of structuring components, describing systems, basing on use of text models**

Each social object functions in framework of some environment to which it is bound and generally, such environment determines character and regularity of functioning of $SO$ in general and its components. So, to describe $SO$ by text models ($TM_i$), data about environment are used, which we will call subject area of interpretation of text models.

Beside semantic dictionaries ($S_C^i$) of different types, to describe subject area ($W_i(PO)$) a number of components is used, allowing reflection of structure $W_i(PO)$. Element, reflecting structure $W_i(PO)$ is a functional semantic dictionary, in which are described all functional dependencies, determined in $W_i(PO)$ and accepted as permissible. Such dictionary ($S_C^F$) describes functions specifically and
does not conform with mathematical concepts of functional relations which are described in visible or invisible form, in tabular form or in other forms, used in mathematics [6, 7]. Formally, fragment of such dictionary is written down as:

\[ S_S^F = \varphi_1^* : \{ x_1 \ast \ldots \ast x_k \} \]

\[ \varphi_n^* : \{ x_{ni} \ast \ldots \ast x_{nk} \} \]

where \( \varphi_i^* \) is fragment or set of fragments from \( W_i(PO) \), which is formed out of elements \( W_i(PO) \), listed in brackets. As in that case we talk about environment, which is not subject for strict formal description, where strict means use of formal mathematics, then relevant relations are specific and are described by text phrases and dictionary \( S_S^F \) describes only those elements from \( W_i(PO) \), which have some relations with each other. Dictionary \( S_S^F \) describes some list of relations, which take place in \( W_i(PO) \), which is formally described as:

\[ S_S^F = f_i^* : \{ x_{i1} j(f_{i1}) x_{ik} j(f_{ik}) \ldots j(f_{in}) x_{in} \} \]

\[ f_m^* : \{ x_{mi} j(f_{mi}) \ldots j(f_{mk}) x_{mk} \} \]

where \( j(f_i) \) – text description of relations between components, placed on both sides of the description. Despite mathematical concepts of functional relations, prototype of identifier presented in mathematics by i.e. variable \( y \), when \( y = f(x_i, x_j) \), in case of \( S_S^F \) such identifier is component \( x_i \) from subject area, or some phrases, allowing personal interpretation if relevant components or phrases are included into some model \( TM_i \). Other difference between relations in \( W_i(PO) \) and mathematical concepts about functional dependencies is that in most cases it is enough to have relations between arguments and information about type of relations, described by relevant text interpretation \( j(\varphi_i) \). Text description of such relation in framework of functioning of \( TM_i \) is used to form new fragments of text descriptions, if it is not preconditioned by process of solving task, implemented in \( TM_i \). In that meaning, despite mathematical concepts of functional dependencies, there can be no determination of numeric values, basing on such dependencies in framework of use of relevant functional relations, describing \( W_i(PO) \) at all.

Generally, we can formally describe subject area of interpretation as:

\[ W_i(PO) = \Phi \{ S_C^K, S_S^K, S_S^F \}, \forall e S_C^K = \{ S_C^{KP}, S_C^{KD}, \ldots \} \]

We will not review structure \( S_S^K \) as it is determined by priority levels for separate \( S_S^{KP} \), and sequence of words usage in phrase or sentence is determined by grammar rules. More detailed we will review relations between \( S_S^K, S_S^F \) and \( S_C^K \), in general. As it goes out of interpretation of elements \( S_S^K \), this dictionary describes only fact of existence of relations between elements from \( S_C^K \) first of all with all elements from \( S_C^{KP} \), as words of that type due to their semantic value for \( W_i(PO) \) have higher priority. As texts, formed in framework of \( TM_i \) and information streams (IP_i), have normalized form, then it means that rules \( \gamma_i \) from grammar \( \Gamma_i \) are narrow conditions for forming normalized texts. Well known fact is that any sentence is structured from the point of view of semantic value of words. There is no place for situation when in sentence or phrase that all words are semantically equal. In cases when semantic equity between two or more words takes place, each of those words either has its own priority or is semantically abnormal. Such priorities can be determined by different classes \( S_C^{KP} \).

Let’s review dependencies between \( S_S^K, S_S^F \) in framework of description of \( W_i(PO) \), structure of which is determined by function \( \Phi \). As for \( SP \) and, correspondingly, for \( TM_i \) most semantically important is fact of presence of dependency between different elements \( x_i \) and \( x_j \), and possible amount or type of such dependency are derivative and not always obligatory to conduct analysis of \( TM_i \) then dictionary \( S_S^F \) is supposed to describe fact of existence of such dependency. For social environments it is typical that for forming some conclusions or forming some results of functioning of \( TM_i \), is much more important qualitative evaluation of such dependencies between separate objects \( SO_i \) and \( SO_j \), then their numeric evaluation. So, in many cases of analysis, conducted in framework of \( TM_i \), it is enough to use \( S_S^F \). Dictionary \( S_S^F \) contains descriptions of function types, binding different components from \( W_i(PO) \) between each other. Such function types allow to perform numeric evaluation of consequences of existence of one or another links between elements \( x_i \) and \( x_j \). Difference which is specific for \( W_i(PO) \) of type \( SO_i \), between \( S_S^K \) and \( S_S^F \) is in fact, that for all structural elements from \( S_S^K \) of type \( x_i \ast x_j \) in \( S_S^F \) can exist equivalent fragments \( x_i j(f(x_i, x_j)) x_j \). This means that in \( W_i(PO) \) between \( x_i \) and \( x_j \) can exist links, which are not subject for numeric analysis. Dependencies between separate dictionaries in \( W_i(PO) \) can be described as following schema, which determines transition from one to another from the point of view of their semantic.
coherence. Such schema can be presented as following correlation:

\[
S^K \{S^{KP}_C \rightarrow S^{KD}_C \rightarrow \ldots \rightarrow S^{KI}_C \} \rightarrow S^K_S \rightarrow S^K_S
\]

This schema reflects natural status when we talk about objects like SO. First of all, to determine description of fragment from SO as \(tm_i\) from \(TM_i\), it is necessary to determine elements which in relative \(TM_i\) must be reflected. Such elements are presented in \(S^K_S\). As all other models, the last one should have some structure, determining relations between elements. Set of possible relations between elements is described by dictionary \(S^K_S\). If relations between \(x_i\) and \(x_j\) require numeric analysis and due to their semantic interpretation it is possible, then relevant types of relations are described in dictionary \(S^K_S\).

One of extensions of known semantic parameters [8, 9] are semantic external parameters, marked as \(\pi\). External semantic parameters are assigned to conduct analysis of separate fragments \(TM_i\) with fragments, described or additionally formed in \(W_i(PO)\). Semantic dictionary \(S^K_S\), describing \(W_i(PO)\), is itself a set of descriptions of possible fragments, existing in \(W_i(PO)\) at current moment. As \(\sigma^S(\phi)\), where \(\phi\) phrase is itself medium value of controversy level which is characteristic for separate phrase \(\phi_1\), then \(\pi^S\) will characterize controversy level between \(\phi_1\) from \(TM_i\) and element from \(S^K_S\), which describe separate phrases, taking place in \(W_i(PO)\). This means that phrase, scheme of which is presented in \(S^K_S\) is used in \(TM_i\) with such adequacy level to phrase from \(S^K_S\), which is determined by value of generalized controversy between \(\phi_1\) from \(S^K_S\) and \(\phi_1\) from \(TM_i\). Formally, this can be described by following correlation:

\[
\pi^S(\phi_1^{TM}, \phi_1^{SF}) = |\sigma^S(\phi_1 \in TM_i) - \sigma^S(\phi_1^{*} \in S^K_S)|
\]

In framework of definition \(\pi^S(\phi_1^{TM}, \phi_1^{SF})\) it is necessary to set method of selection of \(\phi_1^{SF}\) for relevant \(\phi_1^{TM}\).

In framework of separate \(\phi_1^{*}\) from \(S^K_S\) their possible structures are generalizing. Generalization means that in framework of \(\phi_1^{*}\) from \(S^K_S\) generalized phrase can be presented as:

\[
\phi_1^{*} : \{x_{i_1} \vee x_{i_2} \vee \ldots \vee x_{i_m}\}
\]

where fragment \(x_{i_1} \vee x_{i_2} \vee \ldots \vee x_{i_m}\) is itself a combined element of possible phrase. This means that \(\phi_1^{*}\) reflects some schema from which can be formed a number of phrases. Obviously any \(\phi_1\) from \(TM_i\) must not be completely equal to schema \(\phi_1^{*}\) in general or with its fragment. So, we can suppose that \(\sigma^S(\phi_1^{*} \in S^K_S)\) in framework of complete schema has its own level of semantic controversy which is determined like \(\sigma^S\) for \(\phi_1 \in TM_i\). On content level \(\pi^N(\phi, \phi_1^{*})\) determines level of semantic controversy between phrases from \(TM_i\) and phrases, described in \(W_i(PO)\) in \(S^K_S\) and are at current moment of time \(t_i\) a basic schemas of phrases of subject area. Obviously, \(S^K_S\) can, in process of functioning of system \(SM_i = \{TM_i, \ldots, TM_m\}\), change, but those aspects we will not review as the period of intactness of basic elements \(S^K_F, S^K_S\) and \(S^K_K\) determines level of stability of subject area of interpretation \(W_i(PO)\).

Concerning parameter \(\pi^K_s\), as external semantic parameter – it is by its nature is similar to \(\pi^S\). So, we will not review it in details, and only write down method of representation \(\pi^K\) as following correlation:

\[
\pi^K(\phi^{TM}, \phi^{SF}) = |\sigma^K(\phi_1 \in TM_i) - \sigma^K(\phi_1^{*} \in S^K_S)|
\]

Let’s mention that \(\sigma^K(\phi_1^{*} \in S^K_S)\) and \(\sigma^K(\phi_1 \in S^K_S)\) for \(S^K_F\) are calculated similar to \(\sigma^S\) and \(\sigma^K\) for \(\phi_1 \in TM_i\), based on usage of concept of semantic value \(\sigma^K(x_i)\) of separate element \(x_i\) from dictionary \(S^K_S\).

Regarding parameters of external semantic excessiveness \(\pi^N\) and external semantic excessiveness \(\pi^D\), then due to the fact that parameters \(\sigma^N\) and \(\sigma^D\) are also determined basing on usage of direct or indirect parameters or characteristics of descriptions \(W_i(PO)\), represented as dictionaries \(\{S^K_F, S^K_S, S^K_K\}\), then we will not review this parameter in details. Regarding semantic uncertainty, then \(\sigma^N\), appears in case, when \(\sigma^K(\phi_1)\) exceeds preset threshold determining maximum value of \(\sigma^S, \pi^N\) determines that semantic controversy \(\pi^K(\phi, \phi_1^{*})\) exceeds maximum level of its value. That means that \(\pi^K(\phi, \phi_1^{*})\) determines level of inconformity of formed in framework of \(TM_i\) phrases \(\phi_1\) of subject area of interpretation \(W_i(PO)\). This fact can have different nature and respectively different explanations. From one side, this can mean that \(\phi_1 \in TM_i\) is too different from phrases, allowed in \(W_i(PO)\), but from the other side, this can mean that \(\phi_1 \in TM_i\) inputs significantly new aspects about concepts, formed in \(\{S^K_F, S^K_S, S^K_K\}\) about \(W_i(PO)\). To solve this alternative can be used methods of analysis of evolution processes [10, 11]. Formally, expression for determination of value \(\pi^N\) can be written down in following way:

\[
\pi^N(\phi, \phi_1^{*}) = |\sigma^K(\phi_1) - \sigma^K(\phi_1^{*})|\quad (1)
\]
External semantic inadequacy $\pi^D(\varphi, \varphi^*)$ can have different variants of qualitative interpretation. This is explained by fact, that excessiveness means absence of some factor or attribute, and ways to supplement relevant fragment $\varphi_l$ can differ. For example, one way of interpretation of $\pi^D(\varphi, \varphi^*)$ can be inadmissibly big value of relevant level of semantic conflict $\sigma^K(\varphi_i)$ and $\sigma^K(\varphi^*_i)$, which can have the following explanation. Level of proximity of semantic values can appear due to fact that in relevant phrases $\varphi_i$ and $\varphi^*_i$ are not used elements, which together with relevant elements of phrases will lead to reduction of level of semantic conflict. Such interpretation is closer to term of excessiveness. Other interpretation of the cause of appearance of excessiveness can be in following. It is known that $\sigma^K$, which is accepted to be determining for $\sigma^D$ means, that neighbor words can have too similar semantic values. In that case we can eliminate one of exceeding words in $\varphi_i$ and, respectively, value $\sigma^K$ of the new pair of neighbor words will decrease, or at least change. In that case, value $\pi^D(\varphi, \varphi^*)$ means unacceptably high level of conformity of $\varphi_i \in TM_i$ and $\varphi^*_i \in S^i$. This means that in framework of $TM_i$ phrase $\varphi_i$ is used, formed in such a way, that it semantically conflicts with descriptions in $W_i(PO)$, as it is enough close to semantics $\varphi^*_i$ from $W_i(PO)$ or some other $\varphi^*_j$ from $W_j(PO)$. For $TM_i$ this means forming in $TM_i$ phrase, which relatively to $W_i(PO)$ is not determined. Such uncertainty can be eliminated by excluding from $\varphi_i$ of some neighbor component, due to which phrase $\varphi_i$ can reduce. Formally, expression determining value $\pi^D(\varphi, \varphi^*)$ can be written down as follows:

$$|\sigma^K(\varphi_i) - \sigma^K(\varphi^*_i)| < \Delta \sigma^K[W_i(PO)] \rightarrow \pi^D(\varphi, \varphi^*) = |\sigma^K(\varphi_i) - \sigma^K(\varphi^*_i)|$$

(2)

In correlations (1) and (2) we could substitute internal semantic parameter $\sigma^K(\varphi^*_i)$ and value $\sigma^K(\varphi^*_i)$, with relevant external parameters $\pi^X(\varphi, \varphi^*_i)$ and $\pi^X(\varphi, \varphi^*_i)$, as $\sigma^K(\varphi^*_i)$ relative to $TM_i$ is external, as $W_i(PO)$ is external environment, in which function systems $TM_i$ and $IP_i$.

Conclusions

To ensure higher adequacy of description of $SO_i$ by text models, in this work extension of parameters, including semantic parameters, which allow conduction of analysis of $TM_i$, paying more attention to peculiarities, conditioned by $SO_i$. So is developed number of external semantic parameters, describing relations between separate objects of modeling system and $TM_i$. Extension of semantic parameters is in introduction of parameters, extending possibilities of interpretation of the modeled objects. For example, usage of such parameter as semantic excessiveness allows reflection of objects parameters exceeding the existing threshold of subject area description. This is typical for social objects, which during their functioning exceed frames of possibilities, existing currently in description of functioning subject area.

Are developed and researched structures of components, which are not included into $TM_i$, to which belong dictionaries of various types, which describe subject area, made of modeling objects and their groups.

Are researched dependencies between separate components, included into modeling system, which allows reflection of additional dependencies, taking place in systems $SSO_i$.

References