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The Essence Of Mathematical Modeling In Maintaining The Cohesion Of Polysemantic Lexemes

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Abstract: *This article presents a viewpoint on the mathematical modeling of polysemantic units that belong to the lexical-semantic category of "spirituality"; the modeling method makes use of the theory of sets and the property of elements. The objective, rationale, and usefulness of using mathematical techniques to language have all been proven. This model discusses the formal formulation of language systems and their analysis using statistical and mathematical techniques. The approach outlines some things to think about regarding language norms and structure, as well as a more thorough examination of how they are used. A thorough examination and formal definition of polysemantic lexemes are part of the modeling process, which takes into consideration the language's phonological, grammatical, semantic, and pragmatic features.*

Keywords: *Model, bases of modeling, polesemantics, modern approach, category of spirituality, modeling, semantic and pragmatic feature.*

1. INTRODUCTION

One of the language's key and intricate characteristics are polysemantic lexemes, which enhance the language's expressive possibilities with their many meanings but also pose challenges for computer processing and natural language comprehension systems. Ensuring the compatibility of polysemantic lexemes is particularly crucial when examining lexical categories and identifying their structural elements. It might be challenging to utilize conventional linguistic techniques to ascertain the meanings of polysemantic words and comprehend their context. Thus, a mathematical modeling approach is suggested in this work to guarantee polysemantic lexeme compatibility. Through mathematical modeling of polysemantic lexemes in the Uzbek language, the primary objective of this research is to ascertain their meanings in various settings, guarantee their compatibility, and develop an algorithm. In computational linguistics, this may be used to boost the effectiveness of natural language processing systems.

Conventional methods for analyzing polysemantic lexemes mostly include contextual and lexical-semantic analysis techniques. However, due to the complexity and diversity of the human language processing process, these approaches may not always produce definitive results. It is possible to quantify this process and use

mathematical equations to represent it through mathematical modeling.Conceptual graphics are semantic or, in other words, conceptual representations of situations and knowledge in natural language comprehension models[1]. This has practical implications for the language system.

As linguistics advances, new, impartial, and contemporary techniques for text analysis are needed. Specifically, mathematical techniques enable the elucidation, extrapolation, and quantitative assessment of language findings. Consequently, this aids in a deeper comprehension of the language's fundamental mechanics and structure. The fields of computer science, psycholinguistics, and acoustics are all strongly connected to linguistics. Through mathematical modeling of the language, it is feasible to demonstrate how the language functions in conjunction with various disciplines. It is possible to model the lexical-semantic category "spirituality" using the set theory. For instance, the lexical units associated with the lexical-semantic field of "spirituality" can be regarded as a single set. Lexical units that reflect various facets of the idea of "spirituality" make up this collection's constituents. Accordingly, a lexical category in linguistics is a collection of concepts that comprises a number of conceptual issues, is distinct from a concept, and has generalizing meanings. It covers a wide range of topics, including lexical words, natural language issues, and unresolved processing components. This issue comes up in the transformational method, classification method, systematization method, comparison method, search engine optimization of the relevance of the results, research on the linguistic relationship between lexemes and lexical categories, analysis of conclusions, and mathematical modeling. The fields of computer and applied linguistics, which are the paths of contemporary linguistics, are seen as being crucial to the study of the formation of the lexical category.

Several recommendations are commonly made utilizing associative processes seen in human speech and mind when creating a model of links to a lexical category and resolving the problem of identifying it. First, let's talk about the semantic properties of words that are connected to the lexical category's structure. Although it's normally not hard to separate a word's meanings, sometimes a word's many meanings might be semantically very close to one another. In these cases, different words There might be wide variations in the way meanings are separated at and within thesauruses"[2]. The second suggestion addresses the problem of classifying (marking) the corpus by using morphological analysis to ascertain if it is a sign, action, or event. The task of morphological analysis is to automatically determine which category each word in the text belongs to; is to determine which lexical-grammatical class the words belong to.

The category's polysemantic and rhetorical meaning is formed and clarified by the two aforementioned concerns. This task might not be as easy for folks as POS-tagging. People frequently disagree on what a word means in a given situation, and their colloquial usages and usage possibilities are not always consistent. due to the fact that this is a complicated procedure including the speech scenario.

Despite these challenges, academics acknowledge that human voice output serves as a standard by which computer output may be evaluated. One of the challenging problems of corpus linguistics is the removal of polysemantic words from a lexical category, as is the case in every language. It is acceptable to begin the beginning work with the development of their language models for this reason. The years in the usage of linguistic corpus made it much easier for the linguists to learn the presence of observation, sample / evidence collection, comparison, and conclusions facilitated this study[3].

The core, center, and periphery are recognized as the lexical category's main units. The premise for identifying the peripheral of ambiguous words is their initial connotative meaning. The lexical category is founded on the idea that lexemes can be connected both directly and indirectly. Lexemes are defined in a syntagmatic connection, indicating that the meaning of the word is decided by the word that follows before or after it. This occurrence may not always occur, though.

2. METHODS

Taking into account the internal possibilities and features of the Uzbek language, we will reflect the primary compounds into the lexical category by modeling the following lexemes "ayb" (blame), "yaxshi" (good) and "aynimoq" (to worsen) through the method of mathematical modeling.

Word	Context	Final meaning
Yaxshi (good)	Narsa (thing)	Sem = category "sign and feature". Natural phenomena
Yaxshi (good)	Shaxs (person)	Sem = category "sign and feature". Character-feature
Yaxshi (good)	Joy (place)	Sem = category "sign and feature". Appearance

Adjv.1.+PS1 Adjv.1 = units in the category of adjectives that combine with a polysemantic word's original (own) meaning. Adjv.1 = {person, a guy, girl, woman...}; j = 1...n. PS1 = an initial (own, denotative) meaning for a polysemantic word. For instance: *yaxshi narsa (a good thing), yaxshi ot (a good horse), yaxshi mashina (a good car)* PS1+Vjps**.** Vjps. = words in the noun group merging with the polysemantic word's original (own) meaning. Njps. = {person, thing, place...}; Adjv = 2...Vrab. For example: *yaxshi fikrlamoq (to think well), yaxshi tushunadigan (understanding well).*

In this article we suggested that the "mathematical method" be used to represent the units associated with the lexical-semantic category of "spirituality". A number of factors contributed to the adoption of mathematical techniques into linguistics. First of all, as linguistics theory and practice advanced, it became necessary to provide precise and impartial techniques for analyzing language and texts. The concurrent use of mathematical techniques to the summarization, measurement, and systematization of linguistic resources has long been recognized as a close ally of linguists in their quest for profound understanding of a variety of enigmas pertaining to the formation of texts or the structure of languages.

Secondly, the growth of the field of study in each science is a result of a number of variables. Science's link to other sciences is one example of such a factor. The use of mathematical language is specifically the basis for the relationship between linguistics and specialized and natural sciences like physiology, informatics, and acoustics.

Third, we shouldn't focus on any one area of computer linguistics, like machine translation, automatic text processing, or natural language-like human-machine communication systems, since practically all of these areas are derived from written program text that is encoded in the computer's "mathematical language" (machine code). After all, language models that have been modified using mathematical techniques provide the foundation of the linguistic help provided by today's intelligent machines. All in all, it is difficult to develop a computer program in any subject without first developing a mathematical model of the issue at hand.

Naturally, linguistics is no exception. As a consequence of assembling a finite or indefinitely large number of items and seeing them as a whole, a set is one of the indefinable, fundamental ideas of the mathematical method. Spiritual groups of the lexical semantic category "spirituality" are a distinct collection, for instance. The units of a set are referred to as its elements. Traditionally, we identify a collection of Latin-style capital letters and their components using lowercase (written) Latin letters.

It may be expressed as follows: The set A is made up of the components a, b, c, and d. {a,b,c,d} = A "+" indicates that the element "a" is a member of the set A; otherwise, it is written as "–." An infinite set is one that has an endlessly large number of elements, whereas a finite set is one that has a finite number of items. An infinite set is the collection of natural numbers, for instance. The Latin alphabet's eight letters are also a limited collection. The meanings of a polysemous word are components if we consider it to be a set.

We'll refer to the sets as A and B. Lowercase letters or numerals, such as a, b, s, or 1, 2, and 3, can be used to identify its components. We shall examine this approach using the lexical category "spirituality" and the example of the word "ayb" (blame). The lexicon of "ayb" (blame), a word with several meanings, has the following form. We use distinct sets to convey this word's meanings:

A = {ayb (guilt), ayb (malfeasance), ayb (fault)}

A list of definitions for the word "ayb" (blame) is shown here, with an explanation of each component enclosed in parenthesis. It enables you to build semantic links between collection components and categorize and organize them.

AYB 1. an action, behavior that violates the rules or norms of etiquette; sin (Set A);

2. (law) Illegal behavior; a necessary condition for criminal prosecution.
(Set B):
3. Behavior that makes a person feel ashamed and embarrassed; shameful work, shame. (C set);
4. A sign-state, thing that violates the norm, the usual situation; shortcoming, defect (set D).
We will model the integration of the spiritual meanings of this word through the "Mathematical Method".
1. Violation of moral standards.
2. law. Act against the law.
3. Shameful action.
4. A sign or state that violates the usual settings.
If these meanings are taken according to syntagmatic and semantic features, the boundary becomes clear. 1 or 2,3 elements that are present in all sets A, B, C and D are called common elements of these two sets (common scheme). A set consisting of all elements of sets A, B, C and D is called a union (sum) of these sets.

3. RESULTS

Since each element in the set is taken only once, the common elements of sets A and B are written once in the union:
A={1+2+3+4.}
B = {1-3) then {2+4}.
C= {1-3-4} then {2}.
D= {1+2+3+4} then general element (UE) =1+3+4.
Private element (XE) = 2
It is evident that while some of the items in sets A, B, C, and D are common, others are distinct. In these contexts, the word "law" helped to distinguish between the meanings.
The database need to contain information about these models. In such a scheme, the parser promises to parse the words accurately. The primary technique used in natural language processing is modeling. The semantic analyzer is therefore a crucial stage in the modeling of homonymous, polysemantic, and polyfunctional words. One can do automatic semantic detection by using the developed models. This helps to raise the standard of automated translation. For instance, "aynimaq," a polysemantic word that indirectly falls under the lexical category of "spirituality," has several meanings and a model of its own.
The definition of "aynimoq" (to deteriorate/to worsen) in the "Definition dictionary of the Uzbek language" is as follows.
1) To lose color, quality, wear out;
2) to lose the original characteristics, purity (about variety, breed, etc.);
3) to change the pure (usual) state for the worse;
4) to be unfit for consumption; to spoil (about food and drinks);
5) to lose the ability to think and speak correctly, thereby worsening the situation;
6) to deteriorate in words of behavior and manners, to change for the worse, to be corrupted;
7) to go beyond the bounds of etiquette, to start speaking things beyond the bounds of etiquette;
8) to change one's mind, intention, to go back on one's intention or word;
9) to disconnect, leave (to abandon) [4].
We first define a collection in order to model this lexeme. Thus, "aynimoq" (to worsen/to deteriorate) is the lexeme that links the nine meanings mentioned above. Its components provide nine meanings. We choose units with the common subject of "spirituality" as set A from these meanings, reflecting the units that are directly and indirectly part of spirituality.
The units of the lexeme "to feel sick" are found in the set B, C, which we define as the remaining special meanings. The following components are included in Set A. A = 3 + 5 + 6 + 7 + 8 + 9.
The set B includes the main meanings of the lexeme "aynimoq" (to worsen/to deteriorate).

B=2+4 One of the special meanings of the lexeme "aynimoq" (to worsen/to deteriorate) is included in the set.
C. C = 1 This can be modeled as follows:
If A={3+5+6+7+8+9} then, {1-2-4}.
B= {2+4} then {3-5-6-7-8-9}.
C= {1} then, {2-3-4-5-6-7-8-9}.
Common element belonging to “spirituality”: (UE) = {3+5+6+7+8+9}.
A private element related to the lexeme "aynimoq": (XE) = 1-2-4. A = {to spoil (to lose its quality), to be guilty (to lose its purity), to be faulty (to be unfit for consumption)}

4. DISCUSSION

Modeling homonymous, polysemantic, and polyfunctional words for a semantic analyzer presents a variety of challenges. First of all, dealing with word semantics is a highly complicated task – due to the fact that the word is an event. The situation is further complicated by the fact that several words in the Uzbek language's explanatory lexicon have unclear definitions and interpretations. Consequently, syntagmatic interactions aid in clearing up their misunderstanding. The lexeme "amal" (action) from the spiritual group "belief" of the lexical category "spirituality" will be used as an example to illustrate this.

1) Realization of science, theory, opinion, life and etc;
2) Faith-related phenomena, belief related phenomena;
3) In general, work to be done, practical work;
4) Responsible duty, position;
5) Possibility, measure;
6) awakening, the beginning of life (about plants, trees, etc.);
7) math. Every type of mathematical calculation;
8) etn Heating, cooling, putting someone's work back, bothering one's house, etc. that which is rested for purposes; magic.

At first look, the word "amal" appears to have nothing to do with spirituality, yet it has been awakened today to indicate "career." It is evident that there are significance. Specifically, the spiritual group "belief," which is regarded as its core component, determines how the lexeme "action" is connected to spirituality. This can be attributed to the widespread belief in "faith-related issue, faith issue," "heating, cooling, putting someone's work back, bothering one's house, etc." that which is rested for reasons; the definition of "magic" or “witch-crafting” is associated with religious belief.

E’tiqod (faith) is one of the core concepts of the spiritual lexical category. The syntagmatic relationship of this lexeme means that it is a lexeme related to spirituality. In the "Definition Dictionary of the Uzbek Language" the lexeme "amal" (action) is mentioned in the sentence "Al-ma'ruf” means all the Islamic actions that must be performed." The syntagmatic relation "Islamic action" in this sentence clarified all confusions and proved that it is a lexeme related to spirituality, that is, a lexeme of "belief". Such lexemes make up a large amount in the explanatory dictionary.

5. CONCLUSION

The lexical-semantic category "spirituality" can be mathematically modeled to enable a more thorough examination of its structure, the identification of connections between lexical units, and an awareness of the inner workings of language. In this instance, objectification and quantitative assessment of language findings are made possible by the application of mathematical techniques like set theory. The provided example is only a model; further study is required to increase the method's potential. To get around these troublesome modeling scenarios, we have suggested a syntagmatic modeling strategy. This offers useful.

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