Journal Homepage: -www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/11086
DOI URL: http://dx.doi.org/10.21474/IJAR01/11086

RESEARCH ARTICLE

PECULIARITIES OF THE USAGE OF ARTIFICIAL INTELLIGENCE METHODS TO SOLVE DIGITAL TRANSLATION PROBLEMS IN THE MODERN LINGUISTICS (BASED ON THE UKRAINIAN-ENGLISH TRANSLATION)

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Manuscript Info

Manuscript History
Received: 05 April 2020
Final Accepted: 07 May 2020
Published: June 2020

Key words:-
Artificial Intelligence Methods, Digital Translation, Decryption Of Texts, Set Theory, Index Values, Alphabets

Abstract

Peculiarities of the usage of artificial intelligence methods to solve digital translation problems in the Modern Linguisticshave been demonstrated in this article. Availability and necessity in the AI translation systems for automatic processes that can be created as neural networks are analyzed. The overall goal of this work was to use Plural Theory for decryption the texts of related systems of writing by referring to a common archaic source. These point out the advantages and practicability of using the conceptual apparatus of set theory, index notation, generality quantifiers and the Euler-Vienna diagram.Taking into account the phonemic and numerical meanings, we formally describe the most common spoken European alphabets: Greek, Latin and Cyrillic. The key contribution of this work is the solution it provides the application of set theory in the context of Gaussian distribution allows changing Index values of alphabets, which will improve the quality of expert systems of automatic translation.

Introduction:-

Since the 60s of the twentieth century, the Artificial Intelligence (AI) is primarily understood as Big Data that can be measured by mathematical methods: regression, classification, clustering, etc. Over the last decade, research on digital numerical array processing in the expert systems, has increasingly demonstrated that the regression is the most important one. The method of regression proved to be efficient for solving a number of various problems for practical systems. Therefore, we demonstrate its application to work with symbolic values (the alphabet is one of them). In this context, these point out the advantages and practicability of digitalization based on the theory of the "family tree"(Kalko, R., 2017). The disadvantage of this approach can be considered its limited nature, when translation problems are considered on the examples of individual terms or phrases, but not using the whole text. There have been several attempts to solve the problem. The solution to this problem is proposed in the universal digitalization and to be performed according to the principles of the binary code of classical Chinese Wen Yang (Kalko, R., 2018).

The Promising expert AI systems for automatic translation can be created on the basis of Eastern thinking as a neural network and should theoretically take into account the classical Chinese world-view systems and understand the object as a self-regulating system, the components of which are combined on the principles of direct and feedback. In the context of the Western tradition of the phonemic alphabet, the task is simplified, because all known writing systems of Western civilization come from a single source – the Phoenician alphabet.

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Theoretical Review

The collective development of writing systems provides grounds for forming a working hypothesis about the possibility of deciphering the texts of related writing systems by referring to a common archaic source based on set theory. Cantor's "naive" set theory has already stated that any mathematical object is a set**(Dauben, J., 1980)**. For example, a natural number is a set consisting of a single element of another set (a natural series), which, first of all, is itself a set of another order that satisfies Peano's axioms, and so on. Instead, Cantor's opponents, especially L. Kronecker, believed that only natural numbers and what is directly reduced to them could be considered mathematical objects.Such a narrowly specialized discussion between the proponents of Cantor and Kronecker is irrelevant to philology, since the studied sets of natural language alphabets are symbols of natural numbers by definition **(Gowers, T.; Barrow-Green, J.; Leader I., 2008).**

In the ancient alphabets, including Greek, Latin, Hebrew, etc., each letter also meant a number, and thus, by adding the numerical values of the letters, it was possible to obtain the numerical value of the whole name. This method was especially widely used by the Jews and was known as hematria (גימטריה)**(Knohl, I. 2012)**. Such a phenomenon is well known in the European culture, beginning with the Revelation of John the Theologian about the "number of the beast": "He who has a mind, let him count the number of the beast, because it is a human number. And its number is six hundred and sixty-six (666 (ΧΞϚ))" (Chapter 13, verse 18).

According to many researchers, John the Theologian, describing the apocalyptic beast, meant the emperor Nero. It turns out that the inscription of Emperor Neuron in Jewish letters is obtained when counting 666. As religious scholar E. Duluman remarked, the number 616, found on many ancient sources, is due to the fact that the title of the emperor was written as "Nero Kesar", which, when counted, gave the number 616. The Greeks wrote the title of Nero as "Neron Kesar", which, when counted, gave the number 666 (Table 1).

N	E	R	O	N	K	E	S	A	R
נ		ר	ו	נ	ק		ס		ר
50	0	200	6	50	100	0	60	0	200
sum									666

It was then, during the course of two thousand years of history, the number of the beast was attributed to thousands of historical persons [6]**(DulumanY., 2009)**. The similar ambiguity of the attempt to analyze logically the Name as a set of phonemic and digital orders is better illustrated by a series of antinomies against the Cantor vulgar understanding of the set: the Burali-Forti paradox, Russell Grellinha-Nelson, Berry, Richard.

Procedure and Methodology:-

ORANGE is the most common AI program that can be used through "learning". We formally describe the most common alphabets using the conceptual apparatus of set theory, index notation, universal quantifiers and Euler-Ven diagrams. So, for this study, on the example of classical Greek (Ελληνικό αλφάβητο), Latin (Latīna vulgaris) and Old Slavonic languages, we use the index notation to enumerate the elements of a set. That is, if there is a set A, then its elements are denoted as a1, a2, a3 etc **(Calzolari V., Stone M. E., 2014)**.

Greek (A) (hereinafter index, Phoneme, if there is a Number) (a1-Α-1; a2-Β-2; a3-Γ-3; a4-Δ-4; a5-Ε-5; a6-Ζ-7; a7-Η-8; a8-Θ-9: a9-Ι-10; a10-Κ-20; a11-Λ-30; a12-Μ-40; a13-Ν-50; a14-Ξ-60; a15-Ο-70; a16-Π-80; a17-Ρ-100; a18-Σ-200; a19-Τ-300; a20-Υ-400; a21-Φ-500; a22-Χ-600; a23-Ψ-700; a24-Ω-800).

Latin (B) (b1-A; b2-B; b3-C-100; b4-D-500; b5-E; b6-F; b7-G; b8-H; b9-I-1; b10-J; b11-K; b12-L-50; b13-M-1000; b14-N; b15-O; b16-P; b17-Q; b18-R; b19-S; b20-T; b21-U; b22-V-5; b23-W; b24-X-10; b25-Y; b26-Z).

Old Slavonic (C) (c1-А-1; c2-Б; c3-В-2; c4-Г-3; c5-Ѓ; c6-Д-4; c7-Ѓ; c8-Ђ; c9-Е; c10-Ѐ; c11- Є-5; c12-Ё; c13-Ж; c14-З-7; c15-S-6; c16-И-8; c17-Й; c18-І-10; c19-Ї; c20-Й; c21-Ј; c22-К-20; c23-Л-30; c24-Љ; c25-М-40; c26-Н; c27-Њ; c28-О-70; c29-П-80; c30-Р-100; c31-С-200; c32-Т-300; c33-Ћ; c34-Ќ; c35-У-400; c36-Ў; c37-Ф-500; c38-Х-600; c39-Ц-900; c40-Ч-90; c41-Џ; c42-Ш; c43-Щ; c44-Ъ; c45-Ы; c46-Ь; c47-Э; c48-Ю; c49-Я).

Note that the study does not take into account obsolete letters, including Greek (F, Ϛ, Ϟ), Latin (Ƕ, Ƒ, Ɲ), Old Slavonic (Ѧ, Ѫ, Ѩ, Ѭ, Ѯ) and some others. In general, we see from table 2. that the set A (Greek alphabet) consists of 24 index values (a1, a2, a3… a24), respectively B (Latin) of 26 (b1, b2**,** b3…b26) and C (Old Slavic) of 49 (c1, c2, c3… c49). We can distinguish subsets of ABCD (a9b9c18, a11b12c23, a22b24c38, a4b4c6, a12b13c25) (Table

5) ABCф (a1b1c1, a2b2c3, a5b5c9, a7b26c14, a21b6c37, a7b8c26, a10b11c22, a15b15c28, a17b16c30, a19b20c32) to construct an Euler-Vienna diagram on digital (d) and phonemic (f) features.

Table 2:-

Δ	4	a4	D	500	b4	Д	4	c6
I	10	a9	I	1	b9	I	10	c18
Λ	30	a11	L	50	b12	Л	30	c23
M	40	a12	M	1000	b13	M	40	c25
X	600	a22	X	10	b24	X	600	c38
A	1	a1	A		b1	A	1	c1
B	2	a2	B		b2	B	2	c3
E	5	a5	E		b5	E		c9
Z	7	a6	Z		b26	З	7	c14
Φ	500	a21	F		b6	Ф	500	c37
H	8	a7	H		b8	H		c26
K	20	a10	K		b11	K	20	c22
O	70	a15	O		b15	O	70	c28
P	100	a17	P		b16	P	100	c30
T	300	a19	T		b20	T	300	c32

The indices do not coincide with other sets in set A: a14, a18, a23, a24 (Ξ, Ψ, Ω); in the set B: b7, b17, b18, b22, b23 (G, Q, R, V, W); in the set C: c2, c4, c5, c7, c8, c10… c13, c16, c17, c19, c20, c24, c27, c33… c36, c39… c49 (В, G, Ґ, Ѓ, Ђ, Ѐ, Є, Ё, Ж, И, Ѝ, ї, Й, Љ, Њ, Ћ, Ќ, У, Ў, Ц, Ч,,, Ш, Щ, Ъ, Ы, Ь, Э, Ю, Я). Other index values coincide in part by the type of subsets AB (a13б14, a20b25 NY), BC (b3c31, b19c15, b10c21 (CSJ)) and AC (a3c4, a16c29 ГП). According to the Euler-Vienna diagram, the sets of the alphabet are divided into subsets. They includeindex values of 4 orders: the highest is ABCD (digital coincidence in three sets), high ABC (phonemic coincidence in three sets), average AB, BC, AC (phonemic coincidence) in two sets) low A, B, C. (no coincidence with other sets) (table 3).

Table 3:-

Index order	Greek (A)	Latin (B)	Old Slavonic (C)
The highest	a4, a9, a11, a12, a22 (Δ, I, Λ, M, X)	b4, b9, b12, b13, b24 (D, I, L, M, X)	c6, c18, c23, c25, c38 (Д, I, Л, M, X)
High	a1, a2, a5, a7, a21, a7, a9, a10, a11, a15, a17, a19, a22 (A, B, E, Z, Φ, H, I, K, Λ, O, P, T, X)	b1, b2, b5, b26, b6, b8, b9, b11, b12, b15, b16, b20, b24 (A, B, E, Z, F, H, I, K, L, O, P, T, X)	c1, c3, c9, c14, c37, c26, c18, c22, c23, c28, c30, c32, c38(A, B, E, З, Ф, H, I, K, Л, O, P, T, X)
Average	a3,a13, a16, a20 (Γ, N, П, Y)	b3, b10, b14, b19, b25 (C,J, N, S,Y)	c4, c15,c21, c29, c31 (Г, C, S,П, J)
Low	a14, a18, a23, a24 (Ξ, Σ, Ψ, Ω)	b7, b17, b18, b21, b22, b23 (G, Q, R, U, V, W)	c2, c4, c5, c7, c8, c10…c13, c16, c17, c19, c20, c24, c27, c33…c36, c39…c49 (Б, Г, Ґ, Ѓ, Ђ, Ѐ, Є, Ё, Ж, И, Ѝ, Ї, Й, Љ, Њ, Ћ, Ќ, У, Ў, Ц, Ч, Џ, Ш, Щ, Ъ, Ы, Ь, Э, Ю, Я)

At the beginning, the most famous in the European tradition "digital" translation of the term "Neron Kesar" from Greek into Latin - "Nero Kesar" and numerous attempts to read it by different ethnic groups at different times were illustrated. This fragment is a part of the general Bible translations from the Aramaic globalized languages of the Roman Empire, the Greek Septuagint (completed in 132 BC) and the Latin Vulgate (Saint Jerome Ἱερώνυμος (340-420 AD)). The term is rewritten in Aramaic for the transfer of name and title, despite the affinity of the Greek and its descending Latin alphabet, then digitized on the principle of Letter-Number. The total sum of the numbers is equal to the ascending plus (or minus).Thus, this example has the specific characteristics of another language. The data clarify that the letter N and the number 50 characterize the flexibility of Latin.In our opinion, the orders of index values of the set of a certain alphabet selected in the work should be used in the translation practice according

to the principle – Litera-Index-Index value. It will be verified on the example of English translation (set D; index values d1, d2… d26) and in Ukrainian (E; e1, e2 … e33) (Table 8).Therefore, it is possible to distinguish index values of 3 ordersfor two sets D and E: high: DEd (digital match); average: DEf (phonemic coincidence); low D and E (no coincidence with another set) (table 4)

Table 4:-

Index order	English (D)	Ukrainian (E)
High (3)	d4D1, d9I0, d12L1, d13M1, d24X1	e12Д1, e12I0, e16Л1, e17M1, e26X1
Average(2)	d1A0, d2B1, d3C1, d5E0, d6F1, d7G1, d8H1, d11K1, d14N1,d15O0, d16P1, d18R1, d19S1, d20T1, d21U0, d22V1, d26Z1	e1A0, e3B1, e7E0, e9Ж1, e10З1, e15К1, e18H1, e19O0, e20П1, e21P1, e22C1, e23T1, e24У0, e25Ф1
Low (1)	d10J1, d17Q1, d23W1, d25Y1	e2Б1, e4Г1, e5Г1, e8Є0, e11И0, e13Ї0, e14Й0 e27Ц1, e28Ч1, e29Ш1, e30Щ1, e31Ь, e32Ю0 e33Я0

Sets D and E form subsets of different combinations of index values in the form of words, sentences and texts. The absence of a universal universal grammar for natural languages, despite numerous attempts to create it from the grammarians of Por-Royal (Grammaire générale et raisonnée de Port-Royal), allows us to perceive these subsets as a combination of "random" indices, which are subject to statistical (Gaussian) distribution, according to which the convergence of the distribution of the sum of independent equally distributed random variables approaches the normal distribution.

At first, let us do a simple experiment of digitalization of a subset of the word. At the same time, we shall consider only its index order. Concequently, the high order of the index has a numerical value of "3", medium "2" and low "1". In our study, it would be of special interest to use color universals.Traditionally, there are seven colors of the rainbow in the sequence of decreasing light wavelength: red (less than 740 nm), orange (orange), yellow, green, blue, blue, purple (more than 380 nm).Red 2 2 3. Черв-оний 1 2 2 2 2 2 1 1, etc. Referring to the example, it is possible to make the preliminary conclusion about performance of normal distribution on an example of separate words even on an index order. Gaussian distribution is shown by examples of subsets of words: Черв-оний 1 2 2 2 2 2 1 1; Жовт-ий 1 2 3 3 2 1; Зелен-ий 2 2 3 2 2 1 1; Blue 2 3 2 2; Блакитний 1 3 2 2 1 2 1 1; Син-ій 2 1 2 3 1; Purple 2 2 2 2 3 2; Фіолет-овий 2 3 2 3 2 2 2 2 2 1 1; White 1 2 3 2 2; White 1 3 3 1 1; Black 2 3 2 2 2; Чорн-ий 1 2 2 2 2 1 1. In addition, we can distinguish a uniform means of distribution of subsets of words (Orange 2 2 2 2 2 2; Green 2 2 2 2 2) ascending (Red 2 2 3) and descending (Yellow 2 2 2 2 1 1). In addition to the above, it should be recalled that the English alphabet in the British Received Pronunciation is based on the Latin alphabet and consists of 26 letters. There are six letters denote vowel sounds: A, E, I, O, U, Y (monophthongs and diphthongs, alone or as part of digraphs) and 20 letters denote consonant sounds: B, C, D, F, G, H, J, K, L, M, N, P, Q, R, S, T, V, W, X, Z. **(Upward, C.; Davidson, G., 2011).** The modern Ukrainian alphabet is Cyrillic and consists of 33 letters, which are used to denote 38 phonemes in writing. Consonant sounds – Б, В, Г, ґ, Д, Ж, З, К, Л, М, Н, П, Р, С, Т, Ф, Х, Ц, Ч, Ш, Щ. **(Kubijovyč V. ed., 1963)**Thus, we can also use the consonant-vowel criterion, which in the binary system is denoted by (1 and 0) (consonants are denoted by 1, because in the history of alphabetic writing the first characters were of the consonant type) (Red 1 0 1. Черв-оний 1 0 1 1 0 1 0 0, etc.).

Even a cursory glance allows us to draw conclusions about the presence in the Ukrainian translation of features characteristic of inflectional languages. This encourages the search for further common features.We combine the materials of the first and second stages from Table 8 (see Table 4). In general, the English alphabet shows the Gaussian distribution (1-4-0 for vowels (0) and 4-13-4 for consonants (1)), the Ukrainian alphabet shows 1-4-6 for vowels (0) and 4-10-7 by consonants (1)).

For further research, we change the index values within the sets of English (D) and Ukrainian languages (E). Traditionally, index values were denoted by a place in the alphabet (see table 8). The mentioned system had strong influences of external factors especially in the Ukrainian alphabet. In general, only from the time of writing I. Kotliarevsky's Aeneid in 1798 to 1905, up to 50 different spelling systems were proposed. Therefore, in our opinion, the applied set theory in the context of Gaussian (normal) distribution allows to change the index values of alphabets depending on the use of letters. Let us denote the index values of the letters in the new order using the order of the index from high to low (Table 5).

Table 5:-

Order Index	English (D)	Ukrainian (E)
High (3)	d1D, d2I, d3L, d4M, d5X	e1Д, e2I, e3Л, e4M, e5X
Average (2)	d6A, d7B, d8C, d9E, d10F, d11G, d12H, d13K, d14N,d15O, d16P, d17R, d18S, d19T, d20U, d21V, d22Z	e6A, e7B, e8E, e9Ж, e10З, e11К, e12Н, e13О, e14П, e15Р, e16С, e17Т, e18У, e19Ф
Low (1)	d23J, d24Q, d25W, d26Y	e20Б, e21Г, e22Г, e23Є, e24И, e25Ї, e26Й,e27Ц, e28Ч, e29Ш, e30Щ, e31Ь, e32Ю,e33Я

Now we combine the formal features of the set: the order of the index of the letter (3,2,1), vowel or consonant (0,1) and the index value (d1… d26 and e1… e33) on the example of the translation of rainbow colors (Red + 2) +1 2 + 9 + 0 3 + 1 + 1) 36. Черв-оний (1 + 28 + 1 2 + 8 + 0 2 + 15 + 1 2 + 7 + 1 - 2 + 13 + 0 2 + 12 + 1 1 + 24 + 0 1 + 26 + 0) 68-150, etc.).It can be concluded in advance that "digital translation" allows the researcher to abstract from the word as a set of symbols and focus on its very meaning, as a phonemic phenomenon encoded by the symbols of the alphabet. It is clear, that the logic of the research allows the author to improve the index values of the English and Ukrainian alphabets for further digital translation by detailing the Index Procedure taking into account consonant and vowel (1 and 0) phonemes (see table 6).

Table 6:-

Index order	English (D)	Ukrainian (E)
High Consonants (3-1)	d1D, d2L, d3M, d4X	e1Д, e2Л, e3М, e4X
High vowels (3-0)	d5I	e5I
Average consonants (2-1)	d6B, d7C, d8F, d9G, d10H, d11K, d12N, d13P, d14R, d15S, d16T, d17V, d18Z	e6B, e7Ж, e8З, e9К, e10Н, e11П, e12Р, e13С, e14Т, e15Ф
Average vowels (2-0)	d19A, d20E,d21O, d22U	e16A, e17E, e18O, e19У
Low consonants (1-1)	d23J, d24Q, d25W,	e20Б, e21Г, e22Г, e23Ц, e24Ч, e25Ш, e26Щ
Low vowels (1-0)	d26Y	e27Є, e28И, e29Ї, e30Й, e31Ь, e32Ю,e33Я

Considering the new index values, the digital color translation will look like this:

1. (Red (2 + 14 + 1 2 + 20 + 0 3 + 1 + 1) 44.
2. Черв-оний (1 + 24 + 1 2 + 17 + 0 2 + 12 + 1 2 + 6 + 1 - 2 + 18 + 0 2 + 10 + 1 1 + 28 + 0 1 + 30 + 0) 69-93 etc.).

Noe we compare the first and second versions of digital translation in the Table 7.

Table. 7:-

English	Ukrainian	I variant			II variant		
		Σ1 англ.	Σ2 укр.	Σ2-Σ1=135,2	Σ1 англ.	Σ2 укр.	Σ2-Σ1=64,5
Red	Черв-оний	36	218	182	44	162	118
Orange	Оранж-евий	87	208	121	110	164	54
Orange	Помаранч-евий	87	320	233	110	218	108
Yellow	Жовт-ий	96	166	70	111	116	5
Green	Зелен-ий	72	162	90	88	139	51

Blue	Блакитний	50	274	224	61	177	116
Blue	Син-ій	50	150	100	61	97	36
Purple	Фіолет-овий	98	234	136	101	177	76
White	Біл-ий	80	120	40	89	96	7
Black	Чорн-ий	52	208	156	60	134	74

The columns of the table contain the total sum of digits of index values (the order of the index and vowel-consonant are considered) Σ1, Σ2 and the difference between them (Σ2- Σ1), which characterizes the "quality of translation".Please note that the average in the second option decreases from 135.2 to 64.5. It indicates the adequacy of the proposed method.To end the experiment, we use digital translation, taking into account the traditional alphabetical index values (0-option): Red (2 + 18 + 1 2 + 5 + 0 3 + 4 + 1) 36; Черв-оний (1 + 28 + 1 2+ 7 + 0 2 + 21 + 1 2 + 3 + 1 - 2 + 19 + 0 2 + 18 + 1 1 + 11 + 0 1 + 14 + 0) 69 (69), etc ... The options for digital translations are summarized in the Table 8.

Table 8:-

English	Ukrainian	0 variant			I variant			II variant		
		Σ1 англ.	Σ2 укр.	Σ2-Σ1=54,5	Σ1 англ.	Σ2 укр.	Σ2-Σ1=135,2	Σ1 англ.	Σ2 укр.	Σ2-Σ1=64,5
Red	Черв-оний	36	138	102	36	218	182	44	162	118
Orange	Оранж-евий	75	123	48	87	208	121	110	164	54
Orange	Помаранч-евий	75	177	102	87	320	233	110	218	108
Yellow	Жовт-ий	106	92	-14	96	166	70	111	116	5
Green	Зелен-ий	62	98	36	72	162	90	88	139	51
Blue	Блакитний	51	131	80	50	274	224	61	177	116
Blue	Син-ій	51	88	37	50	150	100	61	97	36
Purple	Фіолет-овий	86	173	87	98	234	136	101	177	76
White	Біл-ий	78	66	-12	80	120	40	89	96	7
Black	Чорн-ий	44	123	79	52	208	156	60	134	74

Please note that the proposed version of the digital arrangement of alphabetic characters, considering set theory and Gaussian distribution is not inferior to natural with a complete translation of the term.But at the beginning it was noted that the Ukrainian language belongs to the group of inflectional languages, and therefore it is more appropriate to use not a complete, but a "root" translation (the roots of Ukrainian words in the text are highlighted). The "root" translation of color names in Ukrainian and English are summarized in the Table 9.

Table. 9:-

English	Ukrainian	0 variant			I variant			II variant		
		Σ1 англ.	Σ2 укр.	Σ2-Σ1=17.2	Σ1 англ.	Σ2 укр.	Σ2-Σ1=2.9	Σ1 англ.	Σ2 укр.	Σ2-Σ1= -5.3
Red	Черв-оний	36	69	33	36	68	32	44	69	25
Orange	Оранж-евий	75	81	6	87	68	-19	110	76	-34
Orange	Помаранч-евий	75	135	60	87	129	42	110	130	20
Yellow	Жовт-ий	106	65	-41	96	57	-39	111	56	-55
Green	Зелен-ий	62	71	9	72	55	-17	88	79	-9
Blue	Блакитний	51	104	53	50	111	61	61	117	56
Blue	Син-ій	51	58	7	50	59	9	61	58	-3
Purple	Фіолет-овий	86	118	32	98	78	-20	101	87	-14
White	Біл-ий	78	39	-39	80	34	-46	89	36	-53
Black	Чорн-ий	44	96	52	52	78	26	60	74	14

Conclusions:-

The analysis of language material on the example of European languages (Greek, Latin, Church Slavonic, English and Ukrainian) allowed us to conclude that it is appropriate to use the term "digital translation" when the ascending

and final term is digitized taking into account the Index Procedure, Index Value and other indicators for translation adequacy assessment. This allows us to perceive the alphabetic symbols of European languages as mathematical sets, and the translation process itself can be explained not at the verbal but at the phonemic level, as a Gaussian distribution of random indicators.

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