
ANALYSIS OF THE RUSSIAN NARRATIVE TREND MODELS IN THE INFORMATION SPACE

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Abstract

Currently, the global information space is filled with narratives. They are varying in purpose and level of stratification. The narratives of the occupying forces have been aimed at different target audiences since the beginning of the Russian-Ukrainian war. These narratives pose a threat to the information security of the state, society, and the individual. Timely detection of the main messages that are subordinate to Russian narratives can serve as indicators of the information operation.

It is quite important to understand the concept of the sequence of reactions to independent events, that may be mistakenly perceived as containing messages. The analysis should contain a combination of theoretical and situational explanations of the revealed regularities and the specified outbursts.

It is recommended to determine the limitations that will be applied in the study for the formation of data input. Namely, these are three basic narratives, the statistics must be significant enough for a considerable length of time and they are designed for three different target audiences.

According to accepted restrictions it is popular to use special software to collect statistics, which allows analysts to extract data from the content of the information space following specified requests. This is usually possible due to the use of methods of artificial intelligence and machine learning. Access to the received sets of semantic and metric data (data sets) allows the use of mathematical methods of analysis. One of the common approaches is to find the regression function by comparing the obtained approximation functions. Such a comparison of the obtained mathematical models can be performed considering the nature of the phenomenon, accuracy indicators and the adequacy of the behavior of the regression model during its extrapolation.

Accordingly, it is possible to determine the main dynamic-behavioral features of the phases of the Russian information operation due to a rough comparison of the convergence of the regression curves and the standard one.

Key words: dynamic narrative model, information space, narrative, information operation, monitoring system, data set.

Introduction

After the beginning of the full-scale invasion of the Russian Federation on the territory of Ukraine, the war in the information environment took on new forms. Obviously, the Russian Federation avoids classical methods of information operations. Approaches to the use of narratives, which

become most important when the enemy conducts an information attack or operation, are becoming more widespread. It is quite obvious that the dissemination of Russian narratives during the information operation (IO) is carried out to different audiences. In particular, at the Ukrainians, at the Russians – their own people, at the world and European audience in particular.

The concept of “information space (or sphere)” was formed as a result of the evolution of different spheres. There is geopolitical dimension, that has properties and makes it possible to consider them as independent spaces with their own resources, structure, boundaries and features of activity, interaction of subjects. The information space is dynamic, quickly adapting to the challenges of the development of modern society, serving the interests of the state and influencing it.

Information space is changing the content of such processes as interaction in the process of joint activity and competition. It is due to a change in the content and nature of the competitive struggle between subjects operating in it (Dubnyak, 2015).

According to research (Thomas, 1998), Russia has different prisms of the logic of information operations. These prisms are intent, purpose, lethality or encroachment on sovereignty. This logic can lead to new methods of attacking target audiences in unconventional ways.

Russian military theory pays more and more attention to information warfare. Information warfare is presented as a means of ensuring superiority in an armed conflict by predetermining the outcome: “Information and psychological warfare will be conducted to achieve superiority and control over weapons, as well as to undermine the morale and psychological spirit of the personnel of the enemy's armed forces and the population” (Chekinov, 2015). Until recently, it was believed that designs involving conventional military forces were minimized and replaced by the effective use of the Internet.

In the context of modernity, the aggressor exerts influence on the information space with conducting IO, including spreading narratives. The use of the global Internet network for mass, purposeful influence on the consciousness of citizens of states. There are objects of aggression is of great importance here. Information resources have become one of the most effective types of weapons. Their widespread use makes it possible to destabilize the situation in the country from the inside in a matter of days. Thus, indirect and asymmetric actions and methods of conducting hybrid wars allow the opposing side to deprive it of its actual sovereignty without affecting the territory of the state (Gerasimov, 2016).

This is confirmed by the fact that, in fact, high-ranking Russian officers have assumed that information operations, due to the use of the Internet to influence mass consciousness, can in some cases completely change armed intervention (Kartapolov, 2015).

The dissemination of news topics by the Russians for the implementation of IO is accompanied with reflexive control. Such control is used to describe the practice of pre-changing the adversary's decision in favor of Russia with changing key factors (Kasapoglu, 2015). This approach indicates a proactive formulation of narratives. As such, it is a key asymmetric means of obtaining critical advantages, neutralizing the adversary's strengths, prompting him to choose actions most beneficial to Russian goals (Snegovaya, 2015).

The definition of the term narrative, which is most expediently combined with IO, was given by (Schmid, 2015). “A narrative” as the role of a source for political players who construct a common understanding of phenomena, which makes it possible to shape the perception, beliefs and behavior of a certain target audience.

Today, the Russians are using the understanding that the information line of effort is fundamental not only to give them a strategic narrative, but also to try to justify what they have done before. The Russians also used their narratives to deceive, delay and disrupt certain plans of the enemy, that is, they used them as a “smoke screen” (HCDC, 2016). They are implemented by

topics in news feeds that are filled with false or contradictory messages related to Russian narratives (Rohac, 2019).

The threat of informational influence, as opposed to the use of military force, is another key component of Russian information campaigns. A recurring feature of Russian rhetoric regarding Ukraine, NATO, and the West both before and after the start of the full-scale invasion and annexation of Crimea has been an emphasis on military preparation for conflict, even to the point of discussing the use of nuclear weapons (Kamp, 2015). Sub-narratives of the “Nuclear blackmail” include provocations in the air and at sea, incidents that can be distorted to portray the legitimate activities of the United States or other NATO allies as dangerous and provocative (Giles, 2022).

The detection and refutation of falsehoods in Russian information operations (campaigns) have been at the forefront of Western efforts in the open fight against disinformation. Swift detection and timely response are usually considered important. It is believed that the most effective response is to “create an effective counter-narrative that calls lies as lie” and to analyze “defensive strategic communication that tells people the truth” (Lindley-French, 2015).

At the theoretical level, NATO has already recognized the need for investment in gathering and analyzing early signals to provide guidance on Russia’s excessive activity: “in the beginning, it was important to track and analyze enemy messages and narratives to contribute to early warning and indicators network to help recognize, characterize, and analyze new hybrid threats. The enemy’s message may be subtle to appeal to the target audience in Ukraine, EU or NATO-countries, but by quickly assessing the adversary’s narrative, it will help to get ahead and take the initiative” (FFAO, 2015).

Theoretical background

Today, there are two main directions in the study of information operations (IO) that have gained significant attention over the past few years: those related to “narrative” and those that consider events in the global information space. These areas of study have received attention due to the changing nature of the social and technological contexts in which practicing IO personnel are operating or preparing to work (Giles, 2016).

There are examples of predicted narrative challenges of disinformation are often cited in the Ukrainian information space. It is argued (Revie, 2013) that the speed of the military’s response is a key problem. This is because much of the public and the press do not have the same concerns regarding the accuracy of immediate reporting of events, while the military and governments are constrained by public accountability (due to strategic communication measures) and high responsibility (what Nick Hoving calls “the tyranny of real-time”). However, the examples given [16] often show that the argument of “time” is an abuse of disinformation, which is often quickly exposed on social media and in news, especially the internet. At the same time, disinformation can have a long-term negative impact on the counter-narratives of Ukraine or NATO.

These aspects indicate the relevance of studying the characteristics of Russian narratives in the information space. Research on the search for mathematical approximation functions of narrative dynamics has gained popularity in scientific fields such as computational linguistics, natural language processing, and machine learning. This also includes the development of mathematical models and functions that can approximately reflect the dynamic evolution of narratives.

There are famous researchers who have dedicated their work to studying narrative and building analytical models. Among them is Dragomir Radev, a professor at the University of Michigan, who conducted research on natural language processing and text analysis, with particular attention to narrative summarization and evaluation. The next one is ChengXiang Zhai, a professor at the University of Illinois at Urbana-Champaign, who has conducted research on natural language

processing, text mining, and information retrieval, with a particular focus on temporal and spatial modeling of narratives. Hinrich Schütze, a professor at LMU Munich and University of Stuttgart focus on modeling and understanding text semantics. Regina Barzilay, a professor at the Massachusetts Institute of Technology focus on developing models that can generate coherent narratives.

Problem statement

The research question is to determine models for describing the development of Russian narratives in terms of phases of information operations. It helps to make decision to distribute efforts rationally. This will also make it possible to allocate efforts to respond to Russian influence through narratives, not only as a consequence, but also to understand at what stage the fluctuation of the information space may be for the formation of proactive actions.

Data and methods

1. Declaration of sources of data sets, a method, and approaches to data preprocessing

It is known that only the use of complex systems, based on the use of numerical sources and databases, along with the capabilities of content monitoring systems, can guarantee effective information support in countering information operations (Horbulin, 2009). Therefore, for the study, software tools for monitoring the information space implemented on web platforms, sources and databases for monitoring the information space and corresponding analytical reports were taken. They were obtained at the National Defense University of Ukraine and other organizations of the Ministry of Defense of Ukraine. Detailed statistics of publications on topics were collected using the Semantrum and/or Attack Index content monitoring systems. This made it possible to conduct a retrospective analysis of Russian narratives spread in the information space.

To search for patterns in the statistical processing of data from information space messages on the topics of Russian narratives downloaded from content monitoring systems, the method of least squares (MLS) is proposed. Due to its wide range of applications, MLS occupies a special place among methods of mathematical statistics. The task of MLS is to estimate patterns observed against the background of random fluctuations and its use for further calculations by selecting corresponding mathematical approximation functions.

To search for the mathematical dynamic dependence of the number of themes in Russian narratives, regressions based on Fourier, Gaussian, polynomial, and exponential functions were proposed. Then, by comparing the accuracy characteristics and conformity to the nature of the data in terms of extrapolation, the best regression was chosen. This search for the regression function was carried out using MATLAB software. Accuracy indicators were taken into account: SSE (Sum of Squares Due to Error), R-squared, adjusted R-squared, and RMSE (Root Mean Square Error).

The search for a model for analyzing Russian narratives was carried out by searching through regression functions and comparing them to the generalized (reference) model of the information operation. As a limitation, three narratives were selected for study: “Europe will freeze in winter”, “Nuclear Blackmail”, and “Russia is at war with NATO”. We are finding dynamic narrative model for each of them.

2. Searching for a regression model of Russian narratives

In the context of the selected basic narratives, let's move on to the first narrative, “Europe will freeze in the winter”. This study was conducted from 15.06.2022 to 16.09.2022 (Fig. 1).

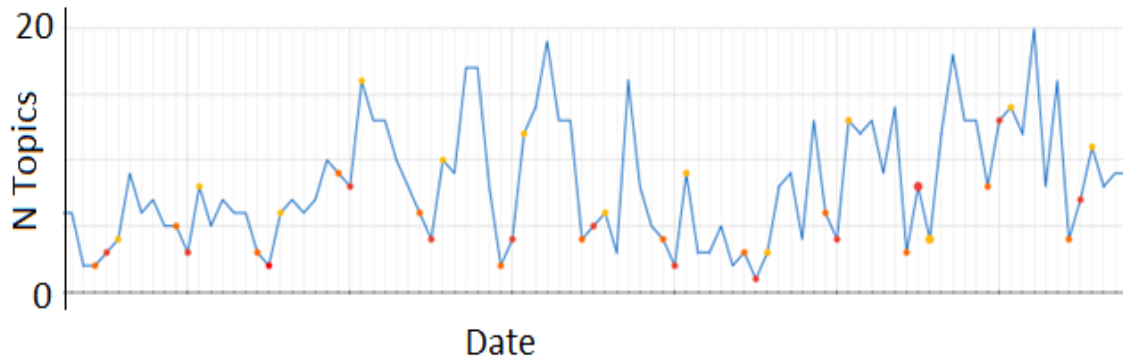


Figure 1 – The graph of news statistics by narrative (Europe will freeze in winter) for the entire study period (from 15.06.2022 to 16.09.2022)

The total number of news articles (from Russian media) that correspond to the selected narrative is 8120 (according to the Semantrum and Attack Index system). The point chart of the statistics for the entire research period is shown in Fig. 1.

On Fig. 1: the X-axis, Date – the study period in days, the Y-axis, N Topics – the number of topics per day (in Russian media). The model analyzes the falls and rises, which have a direct relationship to the calendar. Most of the drops occur on weekends. Most of the increases (peaks) occur on Mondays.

Let us consider the regression functions.

1. The general Fourier regression model (with 4 components), shown in Fig. 3:

$$f(x) = a_0 + a_1 \cos(x \cdot w) + b_1 \sin(x \cdot w) + a_2 \cos(2x \cdot w) + b_2 \sin(2x \cdot w) + a_3 \cos(3x \cdot w) + b_3 \sin(3x \cdot w) + a_4 \cos(4x \cdot w) + b_4 \sin(4x \cdot w) \quad (1)$$

Found coefficients: $a_0 = 8.579$;

$a_1 = -3.965$; $b_1 = 1.655$; $a_2 = -2.113$; $b_2 = 2.09$;

$a_3 = 2.487$; $b_3 = -0.7741$; $a_4 = 0.043$;

$b_4 = 0.4283$; $w = 0.0494$.

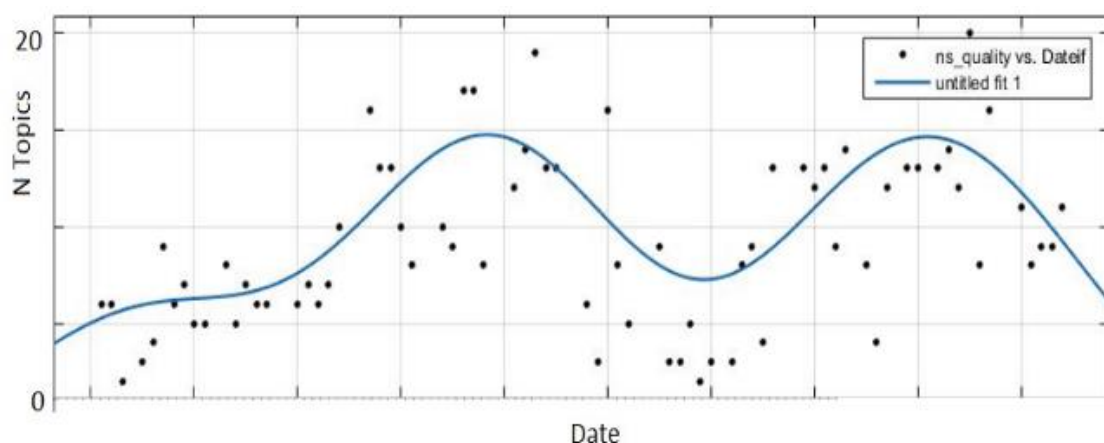


Figure 2 – Fourier approximation model (with 4 terms) of the entire research period for the narrative “Europe will freeze in winter”

The regression model (based on a Fourier function with 4 terms), shown in Fig. 2, has the following accuracy metrics: SSE: 6771; R-squared: 0.4577, adjusted R-squared: 0.4503; RMSE: 3.196.

Next, by comparing the accuracy characteristics and conformity with the nature of the data from the standpoint of extrapolation, we should select the best regression model. Therefore, the next step is to build an extrapolation for each of the taken models (Fourier function, Fig. 3), which will help to understand the nature of the function.

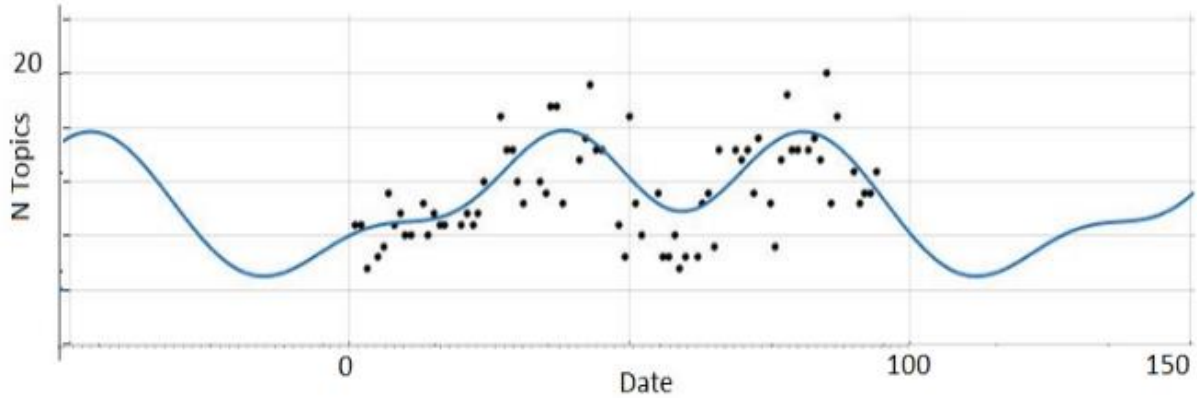


Figure 3 – Extrapolation of the Fourier model in a long-term perspective

The extrapolation of the Fourier model (Fig. 3) shows that the curve of the function behaves predictably. Recurring oscillations can be observed.

2. Gaussian regression model (3rd degree), Fig. 4:

$$f(x) = a_1 e^{\left(\frac{-x-b_1}{c_1}\right)^2} + a_2 e^{\left(\frac{-x-b_2}{c_2}\right)^2} + a_3 e^{\left(\frac{-x-b_3}{c_3}\right)^2} \quad (2)$$

Found coefficients: $a_1 = 14.56$; $a_2 = 11.82$; $a_3 = 6.013$;
 $b_1 = 81.08$; $b_2 = 40.04$; $b_3 = 12.03$;
 $c_3 = 31.61$; $c_1 = 19.39$; $c_2 = 15.42$.

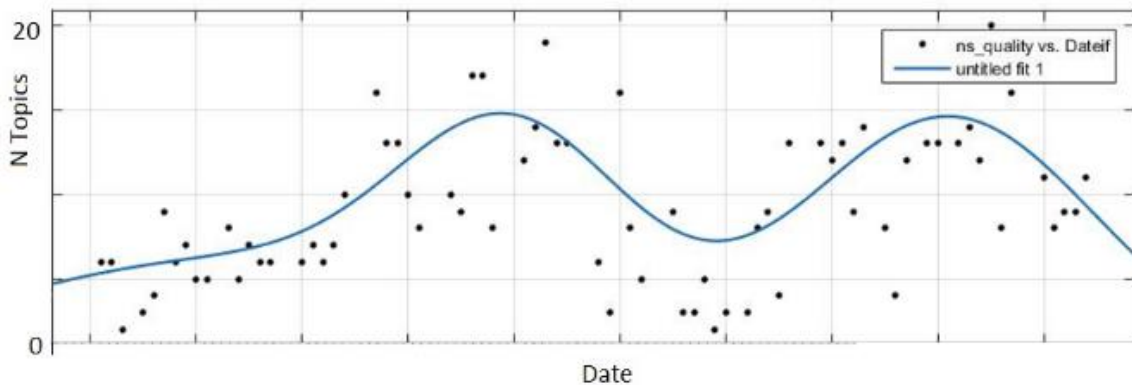


Figure 4 – Gaussian Approximation Model (3rd degree) for the entire research period

Accuracy: SSE: 6771; R-squared: 0.4577; adjusted R-squared: 0.4511; RMSE: 3.196.

Next, we will construct an extrapolation of this Gaussian model (3rd degree) to understand the nature of the function, as shown in Fig.5.

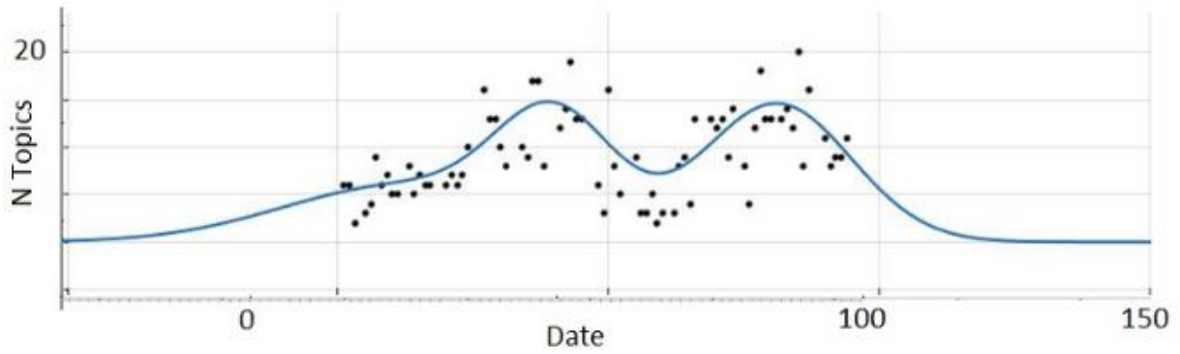


Figure 5 – Extrapolation of the Gaussian model (3rd degree) in a long-term perspective.

The extrapolation of the Gaussian model (3rd degree) shown in Fig. 5 demonstrates that the curve of the function behaves quite predictably.

3. Polynomial regression model (6th degree), Fig. 6:

$$f(x) = p_1x^6 + p_2x^5 + p_3x^4 + p_4x^3 + p_5x^2 + p_6x + p_7 \quad (3)$$

Found coefficients: $p_1 = -0.5384$; $p_2 = -3.318$; $p_3 = -0.6974$; $p_4 = 10.8$; $p_5 = 2.865$; $p_6 = 2.865$; $p_7 = 2.865$.

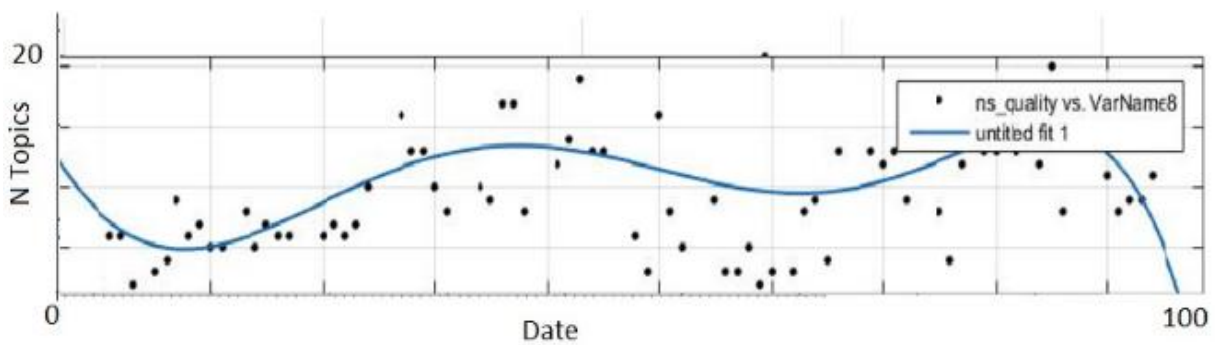


Figure 6 – Approximate 6th degree polynomial model for the entire study period

Accuracy: SSE: 8263; R-squared: 0.3382; adjusted R-squared: 0.3322; RMSE: 3.522.

We will construct an extrapolation of this polynomial model to understand the nature of the function, as shown in Fig. 7.

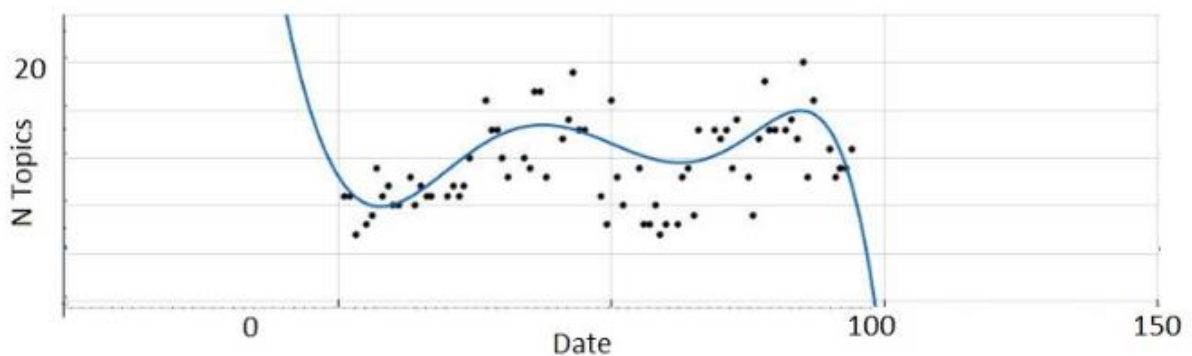


Figure 7 – Extrapolation of the 6th degree polynomial model in the long-term perspective

The extrapolation of the 6th degree polynomial model (Fig. 7) shows that the graph behaves unpredictably (curves up initially, and down at the end), which does not correspond to the nature of the function.

Results

1 Increasing of the number of topics in the Russian narrative

Next, an example is given that explains the peaks of the spread of news topics within the basic narrative in the information space. It is proposed to link the days on which the peaks occur with the prices of Brent crude oil on the exchange during that time. To do this, a scatter plot of fluctuations for the period selected for the study is constructed, based on data from the NY Mercantile agency. There is a screenshot of the financial market web site <https://www.cmegroup.com/> at the Fig.8.



Figure 8 – A screenshot. Dynamics of price changes according to Brent agency data by the Crude Oil Last Day Finance index (BZ=F)

In Fig. 8, the X-axis shows the date, which is the same as the period under study (15.06.2022–16.09.2022), and the Y-axis shows the price per barrel of oil in US dollars. The first time period (the red rectangle in Fig. 8), during which the highest peak in the price chart appears, coincides with the intensity of the spread of news on the determined narrative used for the study (“Europe will freeze in winter”, Fig. 9). This could indicate local successes, situational relevance, or a physical manifestation.

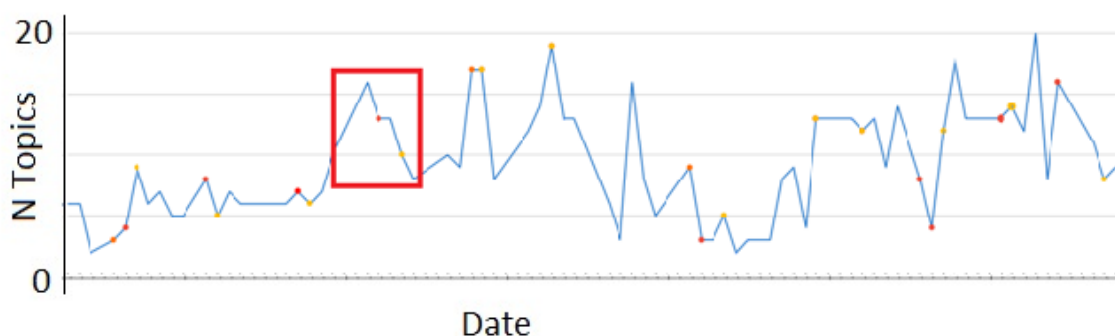


Figure 9 – Graph of the spread of news according to the narrative “Europe will freeze in winter” with a defined zone of oil price growth

2. Generalized model of information operations

To demonstrate the similarity of the obtained model, it is proposed to perform an approximate visual correlation with the generalized model of typical behavior of the intensity series of thematic publications proposed by Professor D. Lande, who has generalized forms and it may reflect to the phase behavior of IO, as shown in Fig. 10.

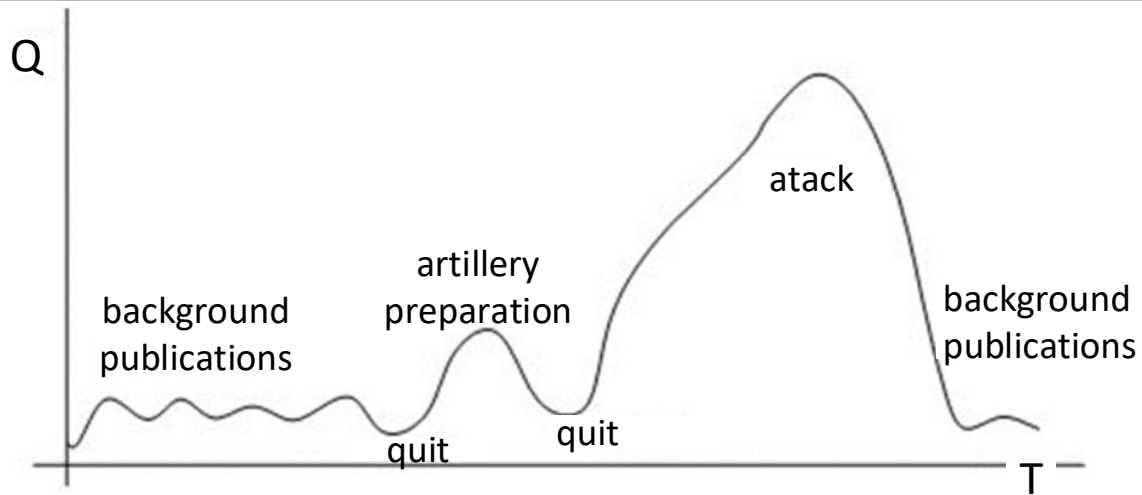


Figure 10 – Generalized model of typical behavior of thematic publications intensity series (T – conditional time period, Q – number of theme messages)

The position on the generalized model of IO regarding the narrative “Europe will freeze in winter” for the entire research period. Thus, a comparison of the visual correlation of the found regression with the model of Lande D. V. shows that fluctuations by the nature of the probability likely correspond to the following sections: background publications. The generalized model (Fig. 10) has various periods of fluctuations, which have phases: background publications (insignificant peaks and dips on the graph, saturation of news topics for the narrative or narratives with weak intensity to create a favorable information background), “quit” (“dips” on the graph, creating a vacuum of news topics for a defined narrative), “artillery preparation” (a sharp rise in thematic publications for a defined narrative, controlled by audience behavior), followed by “quit” (“dips” on the graph, control of audience reaction and military-political leadership actions), “information attack” (growth and peak, decisive phase for achieving goals), “background publications” (decrease and insignificant fluctuations in publication dynamics, explained as an aftermath for sequential completion).

In the IO research by the authors [11], statistical methods and fractal analysis methods were quite widely used, in particular. For the analysis of time series, the authors used the *L*-method with scalograms of process dynamics. At the same time, they argued that content monitoring systems are best suited for operational analysis of the information environment. Such specialized content monitoring systems provide completeness of sources and material presentation. Ordinary news aggregators do not always provide the necessary completeness.

To prevent information operations, it is necessary to carefully monitor the dynamics of publications about the target company. If possible, this should be done taking into account the tonality of these publications and using available analytical tools, such as wavelet analysis [11]. It is important to focus on possible models of information attacks, for example, if this model includes phases: “background publications” – “quit” – “artillery preparation” – “quit” – “attack” (Fig. 10), then it is possible to predict future events with a high probability after the first three components.

Discussion

Comparing it with the generalized mathematical model, the found model (based on the Fourier function with 4 terms) allows visualizing the activity of the narrative within the enemy's information operation. For example, during the period taken for the study, the Russian narrative “Europe will freeze in winter” (Fig. 11) has almost the same number of equal peaks, indicating that the IO is in

the “background publication” phase in terms of the opponent's direction of achieving goals according to the defined narrative.

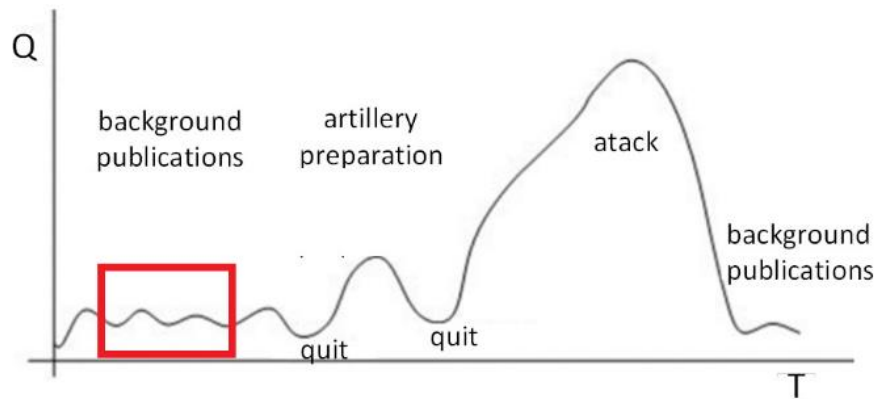


Figure 11 – Place on the generalized model of the Russian narrative “Europe will freeze in winter”

Comparing the visual correlation of the found regression model with the Lande D.V. model shows that the oscillations in character are likely to correspond to the following sections: “background publications”.

The study of the development of the Russian narrative “Nuclear blackmail”. Next, it is proposed to study the selected model on the example of the Russian narrative “Nuclear blackmail” (from 15.06.2022 to 16.09.2022). The corresponding point graph of the statistics of the number of publication topics for the European audience is shown, and the overall Fourier regression model with 4 terms (1) is shown in Fig. 12.

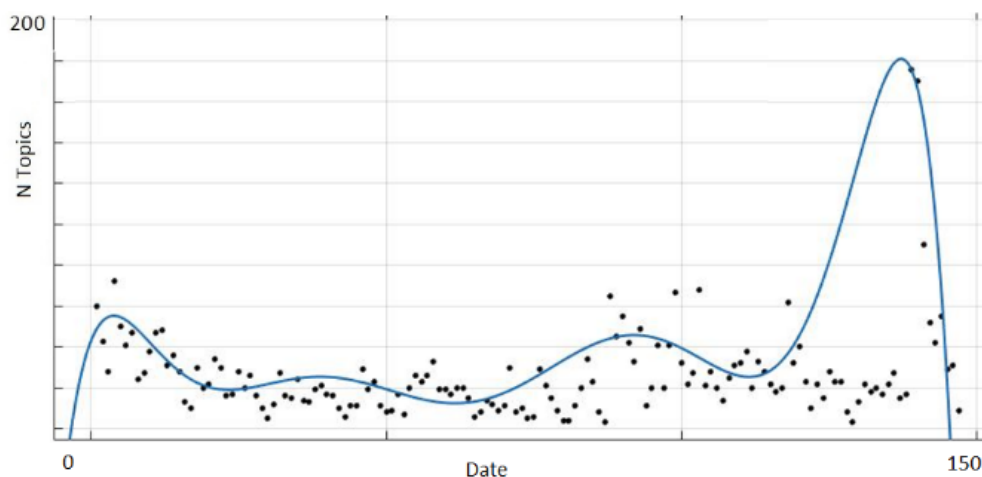


Figure 12 – Statistics of news topics for the narrative “Nuclear Blackmail” (05.06.2022 - 29.09.2022) and Fourier (with 4 components) approximating model

The coefficients for equation (1) for the narrative “Nuclear Blackmail” were found to be: $a_0 = -4.866e+10$; $a_1 = 7.655e+10$; $b_1 = 1.477e+10$; $a_2 = -2.113$; $b_2 = -1.457e+10$; $a_3 = 9.469e+09$; $b_3 = 6.094e+09$; $a_4 = -1.028e+09$; $b_4 = -9.816e+08$; $w = 0.002848$.

Visual comparison of the found regression model for the Russian narrative “Nuclear Blackmail” with the generalized model shows that the fluctuations in character correspond to the following segments: “background publications” – “artillery preparation” – “quit” (Fig. 13).

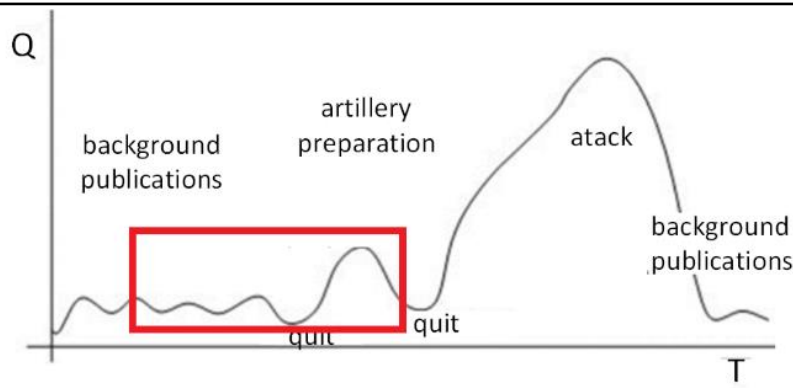


Figure 13 – Location on the generalized model of the Russian narrative “Nuclear Blackmail”

As a result, the obtained approximation function allows us to see the nature of the oscillations of the curve, which indicates that the narrative “Nuclear Blackmail” (as of September 29, 2022) is likely in a “quit” phase after “artillery preparation”.

Next, we propose to investigate the selected model using the example of the narrative “Russia is at war with NATO” (from 23.02.2022 to 06.10.2022). The scatter plot of the statistics of the number of publications for the European audience is shown in Fig. 20.

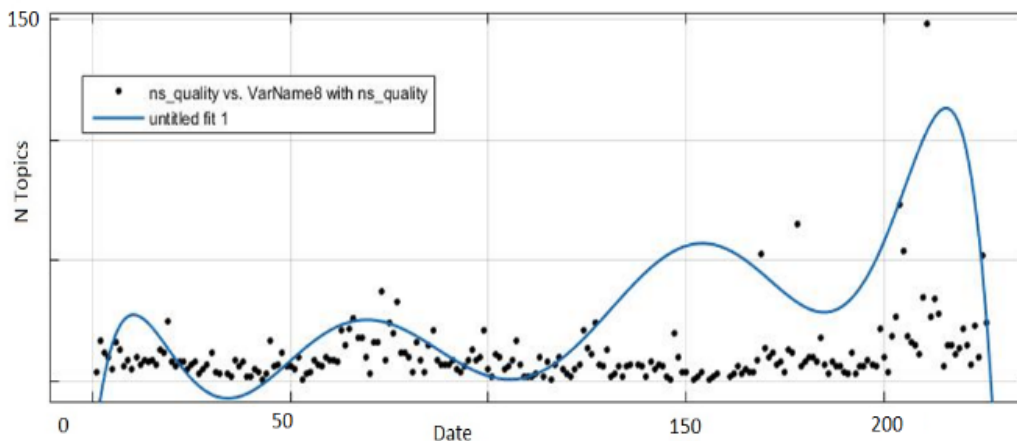


Figure 14 – Statistics of news topics according to the narrative “Russia is at war with NATO” (23.02.2022 - 06.10.2022) and the Fourier approximation model (with 4 terms)

The basis is the general Fourier regression model (with 4 terms), Fig. 20:

$$f(x) = a_0 + a_1 \cos(x \cdot w) + b_1 \sin(x \cdot w) + a_2 \cos(2x \cdot w) + b_2 \sin(2x \cdot w) + a_3 \cos(3x \cdot w) + b_3 \sin(3x \cdot w) + a_4 \cos(4x \cdot w) + b_4 \sin(4x \cdot w) \quad (4)$$

Found coefficients: $a_0 = -1.111e+09$; $a_1 = 1.781e+09$; $b_1 = -1.172e+08$; $a_2 = -8.953e+08$; $b_2 = 1.184e+08$; $a_3 = 2.581e+08$; $b_3 = -5.158e+07$; $a_4 = -3.266e+07$; $b_4 = 8.799e+06$; $w = 0.2151$.

Comparison of the visual correlation of the found regression model of the Russian narrative “Russia is at war with NATO” with the generalized by prof. D. Lande model shows that fluctuations correspond to the following phases: “background publications” – “artillery preparation” – “quit” (Fig. 15), similar to the narrative “Nuclear Blackmail”.

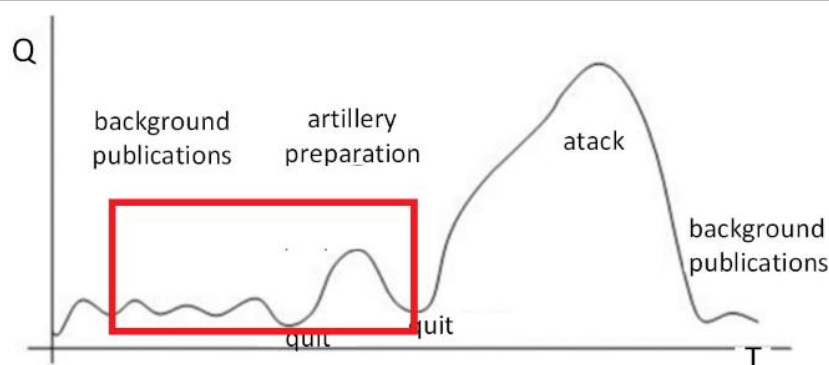


Figure 15 – Place on the generalized model of the IO narrative “Russia is at war with NATO” (for the entire period of the study)

Conclusions

Today, content monitoring systems contain the necessary data processing tools that can provide the user with information on the intensity of publications on a given topic in a required period of time, i.e., act as a statistical source for the study of three common Russian basic narratives. The monitoring system (Semantrum, Attack Index etc.) was used as a data source.

The obtained statistics were processed, and a regression model of the Russian narrative was found. The search was carried out by testing functions for accuracy and compliance with the nature of the phenomenon. As a result, it was proposed to use the found Fourier regression model with four terms.

During the research, a well-known model of typical behavior of the intensity of thematic publications was adopted as a generalization, proposed by professor Lande D.V. This makes it possible to orient oneself in the sequence of IO phases and understand on which IO phases the Russian narrative is located. This is achieved through visual correlation of the nature of the fluctuations of the dependence curve. There were three regression model based on found Fourier regression model with four terms. After this regression models (with found coefficients) were compared with the generalized one (presented by professor D. Lande). For example, the basic narrative “Nuclear Blackmail” was in the “quit” phase after the “artillery preparation” (during the research period). At the same time, the proposed regression model allows one to see the nature of the fluctuations of the curve, which indicates the likely presence of the narrative “Russia is at war with NATO” (at the end of the research period) in the second phase of “quit”, which is similar to the narrative “Nuclear Blackmail”. Meanwhile, the narrative “Europe will freeze in winter” remained in the first phase of background publications.

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Competing interests

The authors declare that they have no competing interests.

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