Artificial Intelligence in the Context of Psychological Security: Theoretical and Practical Implications

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Abstract

The academic community cannot ignore the growing opportunities offered by artificial intelligence. Especially relevant are developments in this ares against the background of growing challenges and threats arising from the use of the digital environment by actors of psychological warfare – by strategists and tactics of "color revolutions' as well as terrorist and criminal groups.

The main objective of the paper is to develop efective instruments to counter the destructive psychological impact on the individual, society, and the state. As a tool in such psychological warfare, the authors see the use of hybrid intellectual systems for decision support bazed on fuzzy cognitive maps, the method of hierarchies, and artificial neural networks. The authors also state for the creation of the mathematical models of decision support in psychological warfare and discuss the need for training based on data mining, obtained from the Internet, using deep learning networks.

Keywords: Artificial Intelligence, Psychological Warfare, Predictive Analytics, Prognostic Weapons, Terrorism, Social Networks, Cognitive Maps, Hierarchy Method, Artificial Neural Networks, Genetic Algorithms, Psychological Security.

1 Introduction

The possibilities of artificial intelligence (AI) and machine learning are growing at an unprecedented speed. These technologies have many areas of social utility, from machine translation to medical diagnostics. The next years and decades will bring immeasurably more opportunities for such applications. The volume of investments in the field of artificial intelligence in the next two decades could be trillions of dollars.Thus, according to a report by the international company PricewaterhouseCoopers Middle East (PwC), published in Dubai during the World Government Summit, worldwide economic growth of 14 % can be expected from the use of artificial intelligence, which is equivalent to 15.7 trillion dollars. According to the PwC, China will realize the greatest growth possibilities – up to 26% of the country's economic growth [16]. These positive aspects of the use of the artificial intelligence are recognized by research teams in different countries and leading international organizations. Much less investigated has been aspects of the malicious use of artificial intelligence, yet these are important because of the possible global catastrophic consequences of such use [1,5,9]. Of particular importance is the use of targeted psychological destabilization of political systems, which puts forward new requirements to ensure international security.

Based on the facts stated above, the direction of "intelligent control" has become critical in the theory of artificial intelligence and decision support systems, shifting the emphasis on the heuristic correction of the formal-mathematical description of the control object for modeling the dynamics of a cognitive system. Various aspects of the problem of

substantiation and heuristic correction of solutions in systems are considered with the help of both a quantitative assessment of factors within the framework of operations research models and a qualitative analysis of the interaction of system-forming factors of the studied subject area in the framework of decision theory and artificial intelligence.

The basis for solving such problems is the analysis of a number of difficultly formalized tasks using expert information and the possibility of adapting the system to the expert's logic and optimizing the processing of expert information, as well as large amounts of unstructured data obtained from the Internet. To solve these problems of intelligent control, we propose to use an approach based on combining various knowledge representation models and soft computing models, which we will call the hybrid knowledge representation model in decision support systems. A key problem to be solved is elaborating the self-learning hybrid model of the knowledge in the system to support decision making for national and international security to minimize destabilizing threats by the use of innovative technologies of psychological warfare. The paper aims to study the methodological, theoretical, and practical implications of the elaborations of such systems, and to study the possibility of integrated, elaborated models of knowledge representation for psychological warfare using machine learning on the basis of textual data and icons.

2 Hybrid intellectual system on the base of fuzzy cognitive maps

In order to solve this problem it is necessary to think about the development of new technologies by combining knowledge representation models, combining a hierarchical (functional) and horizontal (process) approach for managing complex production and organizational projects with the possibility of their training based on text mining using deep-learning neural networks. For this purpose, it is necessary to build an adaptive hybrid intellectual system consisting of Saaty fuzzy hierarchies, fuzzy cognitive maps, alternative ranking models by many criteria and strongly connected quasi-hierarchical structures, and deep-learning neural networks, allowing us to combine analytical knowledge and decision-making models with AI technologies. The creation of a hybrid intellectual system will be combined with the construction of an integrated information space, including a software package of information support and decision support for managing complex organizational projects to ensure the psychological security of any country.

To conduct research in this area, we propose to use the Hibryd intellectual system architecture based on the sharing of fuzzy models of knowledge representation in decision theory, namely, on methods of fuzzy cognitive approach and fuzzy hierarchical assessment of the situation in conditions of fuzzy initial information and machine-learning methods for online adaptation of this model.

Online training of the hybrid intellectual system (HIS) based on neural networks and generetic algorithms will be assumed. The methodology of fuzzy cognitive modelling is based on the representation of knowledge of the situation in the form of a signed digraph, which is called a cognitive map. A fuzzy cognitive map is a causal network that reflects a certain area of knowledge through arcs and tops of a fuzzy networks. The procedure for constructing a cognitive map is called cognitive mapping. This process is based on the methods of adaptation of a fuzzy cognitive map or on the use of direct expert assessments. When building a cognitive matrix, it is necessary to determine which of factors is the cause and which is the consequence. When establishing the influence, it is necessary to determine the reinforcing or weakening effect that the strengthening of the factor-cause on the effect-factor will have. It should also be noted that terms "reinforcing effect" and "weakening effect" are abstract.

Using further algorithms for working with cognitive maps, we will obtain for each factor of the model the value of the change in its intensity [2, 4, 11]. The model of fuzzy hierarchical assessment of the situation is a rigidly fixed model, the construction of which is carried out from the point of view of the obtained expert assessments and fuzzy cognitive maps factors. Changes in this structure occur only if such a decision is made by a decision maker or when deep learning network discover on the Internet or social networks the features that affects the model parameters [8, 17, 18]. Hibryd intellectual system approach can upgrade many decision support systems on the base of fuzzy maps, e.g. for identifying critical path in strategic domains [19] or public support for insurgency and terrorism [20].

The elaborated hybrid intellectual system should be included in the software package of information support and decision support for managing complex organizational projects. The complex should be implemented based on the latest principles of service-oriented architecture, i.e., it should be set of software components (services), with the ability to access them via the network.

3 The Experience of Practical Implementation of AI-Technologies in the Field of Psychological Warfare

International community disposes only a fragmentary research in the field of the implementation of AI-technologies in the sphere of psychological warfare. However, recent documents of a number of

developed countries and international organizations directly set the task of carrying out such projects in the near future. Thus EU documents, for example, emphasize the scientific and practical importance of such studies and their role in solving EU security problems [6].

The most well-known methods of dealing with destructive content in social networks nowadays are:

- Achievement of the quantitative predominance of positive or neutral news, generating comments that disseminate objective information about events;

- In exceptional cases, removal of content or redirecting Internet users who try to link to a page with malicious content to sites distributing objective information about events.

An example of the latter is the experience of the European Union. “The Redirect Method uses Adwords targeting tools and curated YouTube videos uploaded by people all around the world to confront online radicalization. It focuses on the slice of ISIS’ audience that is most susceptible to its messaging, and redirects them towards curated YouTube videos debunking ISIS recruiting themes. This open methodology was developed from interviews with ISIS defectors, respects users’ privacy and can be deployed to tackle other types of violent recruiting discourses online”[15].

In Europol, communication provisions for counterterrorism are represented by data collection, processing, and analysis. Europol analytical reports, e.g., "EU Terrorism Situation and Trend Report (TE-SAT)", serve as a source of information for Europol itself and for other structures (Eurojustice in particular) [3]. Special attention in this series of publications is paid to terrorist propaganda. Europol experts note the greatest propaganda activity for terrorist organizations with "religious" motives (a separate paragraph, titled "Propaganda", was allocated only for them, a paragraph titled "Radicalization and recruitment" appears in the 2008 TE-SAT report). In 2015, the development of social media tools gave terrorist propaganda a new quality and opportunity, which also stimulated the development of special units within Europol. In 2015, the EU Internet Referral Unit was opened to combat terrorist propaganda and related extremist actions. Also, Europol is actively working to maintain its awareness, which is seen as means to increase the confidence of citizens.

The Centre for the Studies of Legitimacy and Political Protest in Russia launched a programme in 2015 named “Laplace’s Demon”, honoring a well-known mathematical experimentalist in the beginning of the 19th century. This system monitors and analyses the activities of extremist groups and offers decisions regarding the revelation of networks of terrorist recruiters.

The private sector is involved in the counterterrorism struggle in tracking down recruiters, blocking e-wallets, and monitoring correspondence in offices. In February 2015, Andrey Masalovich, former FAPSI lieutenant colonel and founder of the Avalanche Online search and analysis system, was responsible for tracking extremist connections on the Internet and social media in Tatarstan. The company had to warn law enforcement agencies about the threats. Avalanche Online is a family of automated Internet intellectual systems to solve a variety of tasks of monitoring online media, fast re-targeting on new topics, and processing of the collected information. The system automatically filters information by subjects.

There are also examples of cooperation between the public and private sectors in counteracting ISIS propaganda in social media in Russia. In summer 2015, the Sidorin Lab IT Company got a request from a customer interested in the extremist organization called Combat Brotherhood (Boevoe Bratstvo), an all-Russian public organization of veterans. In summer 2015, Dmitry Sidorin, director of Sidorin Lab, at Senator Dmitry Sablin’s request, participated in the preparation of an analytical report on ISIS activity in the Russian segment of the Internet.

The platform SemanticForce provides monitoring and analysis of online media, including social media, to analyze the perception of information by the audience, define user preferences, identify intent to purchase, etc. A software solution from the company Brand Analytics monitors the mentions of brands in social media and mass media with the subsequent determination of key references, removal of the duplicates and bots’ messages, establishment of thematic communities in social networks, etc.

The capabilities of the software product TalkWalker provide the user with methods to retrieve significant data from not only text messages but also images, and thus provide the functionality for keeping track of hashtags, listening to and analyzing social media, conducting competitive intelligence, etc. The functionality of the Internet monitoring platform Kribrum allows the detection of information attacks on brands; however, the implementation of counteracting methods and techniques is left to the discretion of the employees of the attacked company.

A separate niche is occupied by software systems focused on the investigation of incidents using open data from the Internet.

Avalanche Online monitors the media and social networks with the possibility of rubricating the information collected, preparing "dossiers" on individuals on open data, defining the emotional coloring of messages, etc. The features of this complex include the ability to build a graph of user

relationships, information for which is drawn from open sources.

Another successful product that monitors user information on the Internet is Palantir. This tool allows for the analysis basing on data from both open and closed sources, determine the links between them.

Predictive analytics in the sphere of security is today provided by a wide range of companies, such as Recorded Future. Those companies are financed by the venture company Central Intelligence Agency In-Q-It, aimed at definition, adaptation and application of innovative solutions for support of CIA missions and on the whole intelligence community of the USA.

In contrast to the predictive analytics of the past, current software solutions based on big data are more successful in predicting not only a change in the parameters of social processes and their consequences but also specific events. Predictive analytics blend seamlessly into the needs of a new area of intelligence in the US and are collected under the label “anticipatory intelligence”, presented in The National Intelligence Strategy of the United States of America, 2014. This area is concerned with determining and characterizing “possible significant events, strong possibilities or threats to the national interests of the USA” [10].

The Early Model Based Event Recognition Using Surrogates (EMBERS) programme, which was initiated by the Intelligence Advanced Research Projects Activity (IARPA) in 2012, should be considered as a valid product of anticipatory intelligence. The programme is based on big-data application to predict significant events such as civil disorder and election results in regions such as Latin America. In a December 2014 issue of the academic journal Big Data, a group of programme authors considered the project’s results in terms of potential disturbance in Latin America. EMBERS is providing detailed predictions, including the date, place, type of event (such as wage demand or demand for the protection of citizens), and characteristics of the protest population (e.g., educators, factory workers, doctors), with measurement of error in prediction. The programme not only negotiates open sources such as Twitter but also more complicated products such as economic indicators. The programme handles over 5 million messages per day. For the possibilities of civic protest alone EMBERS has made more than 50 predictions (defined as events 30 days from the present moment). In particular, EMBERS predicted the time, dynamics, scale, and severity of protests in June 2013 in Brazil, as well as the scale and character (but not the results) of violent disturbances in Venezuela in February 2014. Its general effectiveness has enabled its expansion in other regions of the world.

The RAND Corporation initiated in 2017 the research project Security—2040, one of the directions of which is research on the impact of AI on security. The authors of the project asked, “Could artificial intelligence upend concepts of nuclear deterrence that have helped spare the world from nuclear war since 1945? Stunning advances in AI—coupled with a proliferation of drones, satellites, and other sensors—raise the possibility that countries could find and threaten each other's nuclear forces, escalating tensions” [7].

In 2017 the Defense Advanced Research Projects Agency financially supported a number of projects in the field of deep learning and NLP “Context Adaptation” [12], “Explainability” [13], “Biologically Inspired Architecture” [14].

The major part of NLP technologies is operating with the aid of deep learning—the field of machine learning that became popular in the beginning of the current decade for the following reasons:

- Accumulation of a large number of training data;
- Elaboration of computing facilities: multicore CPU and GPU;
- Elaboration of new models and algorithms with expanded opportunities and improved productivity, using flexible learning based on intermediate presentations;
- Appearance of training methods with the use of context, new regularization, and optimization methods.

4 Methodological Approaches

Specialists in the field of psychological warfare actively use spin-doctoring (i.e., news management) technology as tornado-spin. It means an attempt to transfer a public interest to another area. Tornado-spin technology is used during a decisive struggle with political competitors to divert the attention of the enemy from messages discrediting the customer. For example, when so-called “black PR” is used against specific leaders of political and public organizations, the team of their spin doctors releases in the news an event, in comparison with which any gossip and discrediting rumour against the leader simply pales. In the field of international relations, tornado-spin can be used to divert the attention of the global community from important decisions taken at the international level. If the decision is directed against the interests of a particular state, the constructed news can at the same time hit the reputation of the state as a whole or its leader in particular.

A purpose of big-data analysis tools is to identify an enemy’s spin-doctoring campaigns in the early

stages. To do this, software is developed to detect messages that have parameters typical of simulated news. Among these parameters are these:

- importance (not objective importance from the point of view of socioeconomic development but the impact of the message on the emotions of content consumers) and relevance of information;
- frequency of appearance of the message;
- ambiguity of possible interpretations of the facts;
- wide amplitude of real comments and interpretations;
- unexpected and non-trivial nature of the message;
- unusual shape and style of the message presentation;
- elitism and esotericism of the message presentation ("is not for all");
- personalizing the fact;
- negative nature of the message (bad news always attracts more attention).

For example, it is possible to check how much the next surge of reports on the "Skripal case" correlates with the beginning of a new phase of discussions on military operations in Syria. It is also possible to analyze the nature of the content, which mentions both events. This provides an opportunity to find out how Russian public attitudes towards the military success of Russia in the fight against ISIS is changing against the background of the Skripal case.

After detecting an informational attack on a country or a political public by means of big-data analysis, the relevant counteraction should be undertaken. Involvement of artificial intelligence in the big-data analysis tools enables us to develop new methods of counteractive psychological attacks. To do this, artificial intelligence should not only identify the synchronization of important events on the world stage with the new phases of psychological warfare but also should be able to:

- predict the turn of events if public opinion changes significantly as a result of an information attack (for example, how this situation will affect the results of federal and regional elections in the near future);
- determine the probability of social upheaval and political provocations as a result of unfriendly spin-doctoring (a prominent example being the worldwide-acknowledged EMBERS predictive analytics tool in the US, which predicts protests and even the degree of violence in the course of them);
- propose options for counter-messages that neutralize the actions of provocateurs, as well as methods for these messages' dissemination;
- propose options for adjusting the policy in the interests of society and the state, aimed at achieving public consensus (the chief aim).

At the same time, there is a dramatic proliferation and daily improvement of methods and systems of influence, which enable their owners to covertly and purposefully affect the object via communication. The more complex and educated a society, the more difficult to affect. To a greater or lesser extent, advertising and media communication carry a hidden burden on people. Massive propaganda and advertising campaigns are still often successful today, especially if they are aimed at particularly "impressible" audiences. But most people are aware of the risks of advertising exposure. Thus they can more or less successfully resist it, if desired.

The possibilities of applying artificial intelligence and working with big data on the basis of media monitoring or social media content analysis will enable us to formulate different scenarios—for example, scenarios of events developing as a result of a particular message. Also, we will be able to offer ways out of possible crisis situations, and even to prevent them.

The software complex of hybrid intellectual systems (HIS) should be able to organize the processing, secure storage, and electronic exchange of confidential information. Developing the software, we will solve a problem of creating a closed, distributed, automated information system. Based on innovative secure information and telecommunication technologies, this system will automate information and analytical support

The HIS software complex should include:

- the possibility of integration with other automated systems;
- the principles of system (network) modularity;
- the possibility of processing, secure storage, and electronic exchange of confidential information, and the possibility of interaction with other automated systems using client-server technology.

5 Conclusion

To conclude it is necessary to point out that the problem stated in the paper has a complex nature, and to solve it, it is necessary to determine the social consequences of the use of artificial intelligence (AI) within the framework of psychological warfare (PW). To do this, it is necessary to explore the possibilities of AI in predicting socially significant events, to assess the socio-psychological and political consequences of the use of advanced technologies in PW, and to investigate the motives of the PW objects' behavior on governments under attack as well as citizens (potential and real consumers of toxic information disseminated by destructive actors).

Within the framework of solving the problem, a number of specific scientific tasks can be identified:

- Determine the list of current and future threats to the public with the help of AI (including operator-controlled and autonomous bots, new quality of fake replicated audio and video information, multifaceted impact on political campaigns, and discrediting public persons).
- Examine the national practices of the use of AI directed towards a direct or indirect destabilizing impact on the political system.
- Identify the role of AI in countering terrorism and psychological aspects of the use of AI in this area.
- Identify capabilities of predictive analytics and predictive weapons using AI.
- Determine the role of AI in the current geopolitical confrontation.
- Investigate the ethical impact of AI on international security.
- Identify ways and means to neutralize the targeted psychological destabilization of political systems using AI.
- Build models of threats to the public consciousness using AI and the system of identification of such threats based on the cognitive maps and the method of analysis of hierarchies trained using neural networks and genetic algorithms.
- Carry out a comprehensive assessment of the situation, forecasts of its development and display of the potential of threats (political, military, information, etc.), and the interests of the individual state (at the operator's choice) on the basis of the hierarchical assessment module.
- Make a forecast and scenario analysis of the situation on the basis of cause-and-effect dependencies of cognitive maps, using the cognitive maps module.
- Carry out on the basis of the module of the neural networks the fulfillment and the online adaptation of the modules of cognitive maps and hierarchic evaluation based on the analyses with the aid of neural networks of the deep learning of the provided sets of texts (text mining) and Internet and social media content (web mining).

Implementation of the tasks stated above requires an interdisciplinary approach, necessitating the formation of a research team of specialists in various fields: political scientists, historians, mathematicians, and specialists in various fields of computer science.

A preliminary vision of different specialists' roles in the project is as follows:

- Social scientists formulate the main threats to psychological and psychophysical security coming from the information environment and formulate the selection criteria of the destructive content (identify the main parameters of messages carrying toxic information and semantic structures used to manipulate socio-political attitudes in society); evaluate role and practice of the malicious use of artificial intelligence in the modern geopolitical confrontation; study deepfakes and their possible influence on the psychological warfare; evaluate ways and means to neutralize the targeted information and psychological destabilization of democratic institutions using AI-technologies.
- It is assumed that the AI system will include training samples of examples of events related to violence and reflected in social networks, in order to predict the possible course of events using deep-learning neural networks. The search for examples is carried out by social scientists, neural network text-mining systems, and hybrid intellectual systems (HIS), in support of decision making. Such a HIS includes the main parameters of public decision-making bodies' motivation in the communication field.
- Specialists in computer science and social scientists jointly develop the scenario analysis, based on the proposed models, and make recommendations on the application or improvement of the results of the HIS use.

Only in that case it become possible to create such an artificial intelligent system that could, based on the information disseminated in the digital environment, not only indicate threats to psychological security in a timely manner but also offer scenarios of counteraction (including counteracting the offensive weapons' systems).

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