UDC: 351.862.2:004.7

DOI: 10.31110/2789-6536/2023-5/008

Shvedun Victoriia
Doctor of Science (Public Administration), Full Professor,
Head of the Scientific Department on Problems of Management in the Civil Defence Sphere of the Educational, Scientific and Production center, National University of Civil Defence of Ukraine, Kharkiv, Ukraine
ORCID: 0000-0002-5170-4222

Ihnatiev Oleksandr
Doctor of Philosophy (Public Management and Administration),
Senior Lecturer of the Department of Military Training,
National University of Civil Defence of Ukraine, Kharkiv, Ukraine
ORCID: 0000-0003-3280-3468

Development of state policy in the field of monitoring the condition of potentially hazardous objects through the utilization of models and information technologies of Sentiment Analysis

Abstract. The ways of utilizing modern monitoring tools for assessing the state of potentially hazardous objects are investigated. The possibility of involving ordinary citizens in the monitoring process of potentially hazardous objects using models and information technologies of Sentiment Analysis is examined.

It has been demonstrated that the territorial and functional subsystems of the Unified State Civil Protection System currently do not ensure proper daily collection, processing, transmission, and analysis of information regarding the probability of emergencies of technological and natural origin, as well as the development of preventive measures and proposals for their implementation. The necessity of establishing and maintaining the functioning of separate, and in some cases, "corporate" situation centers is confirmed.

It is established that the integration of intellectual, informational, and technological models enables the enhancement of the promptness of alerting about potential dangers that may arise (or about dangers that have already emerged)

through the utilization of information obtained from ordinary citizens in the process of monitoring the state of potentially hazardous objects, which is further processed using Sentiment Analysis methods.

Keywords: mechanisms of state governance, monitoring, potentially hazardous objects, emergency situation, Unified State Civil Protection System, information technologies, Sentiment Analysis.

Problem Statement. In 1996, the Program for the establishment of the Governmental Information and Analytical System for Emergency Situations (GIASES) was adopted [1], and three years later, it was approved for the period of 2000-2002 [2]. Specifically, the creation of a Crisis Center within the Information Resources Center of the Cabinet of Ministers of Ukraine was envisaged. As a result, the Central subsystem of GIASES was established for the Management of Expertise and Analysis of the Development of Technogenic, Environmental, Nuclear Safety, and Natural Resource Utilization of the Secretariat of the Cabinet of Ministers of Ukraine.

Undoubtedly, the implementation of GIASES required coordination of numerous interagency issues. Therefore, given the complexity and significance of tasks related to the establishment and functioning of GIASES, a separate coordination council worked on these matters in the years 2001-2007 (chaired by the First Deputy Minister of Emergency Situations and involving representatives of the Secretariat of the Cabinet of Ministers of Ukraine and various departments) [3].

The Civil Protection Code of Ukraine stipulates the necessity of conducting continuous monitoring and forecasting of emergencies (EM) to prevent them. However, "de jure," a nationwide system for monitoring the sources of emergencies and their forecasting has yet to be established in the country. The territorial and functional subsystems of the Unified State Civil Protection System (USCPS) do not currently ensure proper daily collection, processing, transmission, and analysis of

information regarding the probability of the occurrence of technogenic and natural emergencies, as well as the development of preventive measures and proposals for their implementation.

For Ukraine, the complete integration of entities of such nationwide monitoring into a unified system, as well as the development of a unified methodology for collecting, accumulating, and transmitting monitoring information, remains a challenge.

An analysis of the current state of the network for monitoring potentially hazardous objects (PHOs) has shown the need for improving monitoring systems. This is primarily driven by a significant increase in the likelihood of emergencies occurring at potentially hazardous objects due to the deterioration of production assets, as well as the substantial concentration of industrial facilities in various regions of the country. Considering the fact that Ukraine is de facto in a state of war, the possibility of conducting terrorist acts on PHOs to destabilize the military-political situation in specific regions of the country remains on the agenda.

Analysis of Recent Research and Publications. Prominent scientists and practitioners such as Kropotov P.P., Bezhun V.V., Grechaninov V.F. [4, 5], have paid attention to the creation of a modern monitoring system as an essential state and scientific challenge. Researchers including Andronov V.A., Dombrovska S.M., Semkiv O.M. [6], Kravtsov S.Ya., Sobol O.M., Kosse A.G. [7], have dedicated their publications to exploring the theoretical foundations of the mechanism of state management for civil protection in the context of emergencies.

Nevertheless, numerous issues regarding the definition of the content and components of the mechanism for state management of PHO monitoring remain insufficiently explored.

Despite more than twenty years having passed since the adoption of the first GIASES Program, the process of establishing this system is still ongoing. The

gradual development of GIASES was reported in the National Reports on Technogenic and Natural Safety in Ukraine (section "Information Support" – section 5.3 in 2004-2010 and section 6.4 in 2011-2012). Unfortunately, not all planned elements of this system have been implemented. Furthermore, according to data from the State Emergency Service of Ukraine (letter from the State Emergency Service dated February 13, 2014, No. 03-2024/162), in 2013, due to lack of funding, the activities of the Nationwide Targeted Program for Population and Territory Protection from Emergencies of Technogenic and Natural Origin were not carried out regarding the functioning and development of GIASES (section 30 of the program) [8].

It cannot be said that the functions typically assigned to a crisis center were overlooked when the Civil Protection Code of Ukraine was approved in 2012. On the contrary, it mentions a state center for emergency management that is responsible for carrying out "round-the-clock duty and ensuring the functioning of the information collection, processing, summarizing, and analysis system for the situation in areas of emergencies" [9]. Moreover, the work of individual subsystems within the Unified State System for Prevention and Response to Emergencies of Technogenic and Natural Origin is carried out with the involvement of departmental structural units that perform some of the functions inherent in a crisis center. For example, the State Nuclear Regulatory Inspectorate includes an Information-Crisis Center, which is a key element of the "Nuclear Energy Object Safety" subsystem [10].

The aim of the article is to analyze and diagnose issues related to the mechanisms of state management in monitoring the state of potentially hazardous objects (PHOs) in Ukraine under contemporary conditions, as well as to enhance the reliability of PHO monitoring through the utilization of one of the fundamental analysis methods widely employed in Opinion Mining - Sentiment Analysis.

Presentation of the main content. The state of mechanisms governing the state monitoring of PHOs in Ukraine can be exemplified by the Unified Automated Monitoring, Management, and Prevention System for Emergencies [11]. This automated system serves as the foundation, without which the quality functioning of the entire Unified State Civil Protection System (USCPS) would be unattainable.

The monitoring of the state of technogenic objects and forecasting accident potential is conducted by industrial safety and nuclear regulatory bodies, as well as supervisory authorities within central executive bodies according to the respective sectors of the economy [12]. Security forces monitor external destabilizing factors (armed conflicts, terrorist acts, etc.) [13].

For Ukraine, the complete integration of entities involved in such nationwide monitoring into a unified system, as well as the development of a unified methodology for collecting, accumulating, and transmitting monitoring information, remains a challenge [14]. Therefore, legislation only defines tasks for the nationwide surveillance and control system related to the collection, processing, and transmission of information about environmental conditions, food product pollution, food raw materials, feed, and water contamination with radioactive and chemical substances, microorganisms, and other biological agents [15].

The primary instruments for conducting such monitoring include the certification of PHOs, safety declaration of high-risk objects (HROs), expert assessments of the readiness of economic objects and territories for protective actions and functioning during emergencies, comprehensive assessment determining the integral hazard indicators of regions for potential emergencies, and the guidance of the observation and laboratory control network in exceptional periods (hydrometeorological and sanitary-epidemiological stations, veterinary and agrochemical laboratories). The economic benefit derived from emergency

monitoring is achieved through reducing the time needed for preparation and response efforts, as well as obtaining objective data for planning.

A unified information environment for the real-time provision of data for such monitoring to executors, aimed at predicting the risks of occurrence and development of emergency scenarios, is intended to be facilitated by the Governmental Information and Analytical System for Emergency Situations (GIASES) [9]. GIASES was created to support the processes of preparation, decision-making, and control concerning emergencies, based on comprehensive processing of operational, analytical, normative-reference, expert, and statistical data from various sources.

Information about threats or the occurrence of emergencies is transmitted according to an approved protocol through telephone and radio communication channels, initially orally, followed by mandatory written reports through fax or telegraph channels, as well as through computer networks. Preliminary assessment of the threat or occurrence of an event's correspondence to the type and level of emergencies is carried out by available operational and dispatcher services. The communication system ensuring the transmission of text messages, documented reports, video information, and digitally automated data is established in advance and encompasses both stationary and mobile communication networks [16].

To notify the on-duty services of territorial civil protection and emergency management authorities, law enforcement agencies, forces, and the population, specialized centralized alert systems (CAS) are established. These systems operate at the national, regional, local, and object levels [16].

CAS enables circular or selective alerting of on-duty services and officials of central and local executive authorities, local self-government bodies, heads of specific enterprises, institutions, and organizations involved in decision-making regarding emergency protection and organization of actions for emergency

localization and mitigation, on-duty emergency and rescue services, as well as the population residing in potentially affected areas.

Information conveyed to management and forces has an operational nature. Information disseminated to the public includes the nature and scope of the threat, recommendations for protective measures, and the application of safety measures under the prevailing conditions.

Object-specific alert systems are established for potentially hazardous facilities where the impact zone does not extend beyond their premises. These alert systems are designed to notify leaders and other employees of the facility, on-duty emergency services, relevant territorial civil protection and emergency management authorities, and territorial law enforcement bodies via direct telephone lines [17].

Upon receiving information about a threat or the occurrence of an emergency, management authorities and forces transition into a state of heightened readiness or an emergency regime. Workspaces (command posts, crisis centers) of management bodies and emergency response commissions are set up, continuous shifts are maintained on communication systems and information exchange along relevant channels, mobile and working groups of management bodies are formed and initiated, and operational conditions are analyzed.

Duty forces of civil protection and emergency management bodies and mobile emergency assistance brigades are dispatched to the emergency zone to carry out priority tasks related to emergency mitigation, medical-sanitary measures, law enforcement, and continuous information provision on conduct rules within the emergency area under the circumstances that have developed.

The scope and content of emergency mitigation measures are determined while ensuring the required sufficiency and maximal utilization of available resources. During the organization of actions and measures for emergency mitigation, the general structure of management (emergency response commission, authorized

manager for emergency mitigation and their staff, mobile groups of management bodies and services), a complex of emergency mitigation measures and their consequences, force and resource allocation, coordination arrangements, the sequence of force and resource escalation, and the organization of essential provisions within the emergency area are defined [17].

Currently, an operational-dispatch management system (ODMS) is in place. The purpose of ODMS is to maximize the automation of dispatch functions, reduce call processing and dispatching times for equipment, which is a crucial factor during emergency mitigation and rescue operations.

Currently, ODMS manages the functioning of the "112" service by redirecting messages to other emergency assistance services (101, 102, 103, 104) on a temporary basis. It receives and processes calls not only on the "101" special lines but also on the "112" special lines from stationary subscribers of the city's general telephone network and mobile cellular communication subscribers within the city and the region. However, only a portion of processes related to organizing the "dispatcher-applicant" dialogue and displaying operational conditions on an electrified plan are automated at present.

The basis for establishing stable communication with clients at the software level during the reception of emergency calls for 101 and 112 is open-source software (OSS), also known as free software or libre software. Users of OSS have the "freedom" to install, run, use, study, modify (enhance), and distribute it, as well as distribute copies and modified versions. An example of such an application is Asterisk [18].

Asterisk is an open-source project by Digium, initially initiated by Mark Spencer. Asterisk encompasses all the capabilities of a traditional PBX, supports numerous VoIP protocols, and provides features such as voicemail, conferencing, interactive voice menus (IVR), call center functionalities (call queuing and agent

distribution using various algorithms), call detail recording (CDR), and more. To create custom functionality, one can use the Asterisk programming language to write dial plans, either by coding in the C language or utilizing AGI, a flexible and versatile interface for integration with external data processing systems (modules can be written in any programming language).

The structure of Asterisk is entirely modular, and the command-line interface allows reloading individual modules and their configurations without disrupting overall functionality or interrupting established connections. The application transparently interconnects all supported interfaces, integrating various telephony systems into a unified network environment.

Thanks to the open-source license of Asterisk, it is actively developed and supported by thousands of people from around the world. Over the past two years, Asterisk applications have been actively developed in the United States and Europe. In one form or another, Asterisk has established a strong presence in the IT technology market (with over 1000 companies, support centers, and online consultations). Many companies utilize Asterisk in their serial VoIP devices, such as Linksys and Nateks.

It should be noted that, in accordance with the decree of the Head of the State Emergency Service of Ukraine "On Approving the Procedure for Using Information and Information and Telecommunication Systems and the Procedure for Using and Accounting for Computer Programs" [19], the priority within the State Emergency Service is the use of free software. Therefore, all units and subdivisions utilize free office software – a set of office applications that operate under Microsoft Windows and Linux, designed for widespread use in home, office, and corporate systems.

This is positioned as an alternative to commercial proprietary applications. The package includes office programs (OpenOffice.org), an internet browser (Firefox), an email program (Thunderbird), SeaMonkey, a database management system

(MySQL), a graphic editor (GIMP), desktop publishing software (Scribus), a calendar organizer (Sunbird), a vector editor (Inkscape), an archiver (7-Zip), instant messaging clients, as well as supplementary software such as the Java application runtime environment and Adobe Reader.

The extensive humanitarian crisis and the destruction of critical infrastructure in the eastern and southern regions of Ukraine due to large-scale hostilities exposed certain shortcomings in the functioning of the National Emergency Management System (NEMS).

The Civil Protection Code of Ukraine emphasizes the need for continuous monitoring and forecasting of emergencies to prevent their occurrence. However, a comprehensive nationwide system for monitoring emergency sources and forecasting has not yet been established. Consequently, the territorial and functional subsystems of the NEMS do not adequately collect, process, transmit, and analyze information about the probability of emergencies of both technological and natural origin, nor do they develop preventive measures and proposals for their implementation.

Currently, in Ukraine, the emergency monitoring and forecasting system exists in the form of fragmented regional, sectoral, or independent functional subsystems, not integrated into a single information-analytical complex. It fails to conduct systematic and well-founded research on the trends and nature of changes in the main sources of threats to the country's environmental security and requires significant improvement. In our view, one of the ways to enhance the effectiveness of the disaster monitoring system is the analysis of data from social networks.

The concept of a social network was initially used by sociologists in the 1920s to study relationships among members of different communities. Psychologist and psychotherapist Jacob Moreno introduced sociograms, where individual individuals were represented as points and their relationships as lines. The idea of using graph theory to study interactions and relationships between people was adopted by experts

in sociology, psychology, anthropology, political science, and economics, leading to the formation of Social Network Analysis, which examines the structural properties of social relationships modeled as graphs and networks.

Social networks, forums, news and entertainment portals, and blogs contain a wealth of valuable material from which information about accidents, incidents, or adverse situations related to emergencies can be extracted. Automatic text analysis is not possible without linguistic technologies. Furthermore, statistical methods, machine learning technologies, and advanced data analysis (data mining) are also useful for solving various tasks. Statistical research and natural language processing are typically associated with some degree of inaccuracy – statistical language involves certain assumptions and heuristics that are not always fully met, and ambiguity is inherent in natural language, leading to varying interpretations of statements and conclusions. The proper combination of linguistic and statistical approaches improves the quality and reliability of results.

The analytical processing of a large amount of unstructured data allows for knowledge accumulation, identification of patterns, and the development of optimal methods. For instance, after the 2013 terrorist attack on the Boston Marathon, large sets of messages, photos, and videos from social networks were classified and analyzed using high-performance systems, ultimately aiding in the identification of the organizers of the attack. Therefore, "clouds" provided computational power for solving the task, and the efficiency of automated analytics tools was enhanced through information from social media participants.

In recent years, there is a noticeable trend of a significant increase in the number of Internet users, leading to a corresponding growth in the content they generate. People leave messages on forums, write posts on blogs, comment on products in online stores, and engage in conversations on social networks.

It is evident that in the near future, systems with highly automated ETL (extract, transform, load) processes for content structuring will become increasingly in demand. These systems will perform functions of real-time information analysis using methods of intelligent text analysis to derive new insights.

Full-fledged intelligent text analysis is not possible without the development of one of the promising directions in computational linguistics – sentiment analysis of publications. Analyzing the sentiment of text allows the extraction of emotionally charged vocabulary and authors' attitudes towards objects mentioned in the text. This capability enables the analysis of public opinion, automatic generation of statistical reports on societal attitudes towards an object, and more. This information is of significant interest to marketers, sociologists, internet resource owners, and many other professionals.

Various methods for formalizing opinion models are found in the literature, and different terminologies are also used. In English, this research area is commonly referred to as opinion mining and sentiment analysis [20-22]. Alternative terms are proposed as well, such as Opinion Content Analysis (OCA), which refers to a group of methods for studying subjectivity in natural language through the extraction and further processing of opinions and emotions from text [23].

Therefore, sentiment analysis of text is one of the most promising tasks in the field of Natural Language Processing. Most research in this field has emerged in the last 10-12 years, closely linked with the development of social media, blogging platforms, and other information technologies. Subjectivity content analysis is essential for the successful operation of question-answering systems and intelligent information processing systems, where the distinction between facts and opinions is crucial. Hence, the task of developing mathematical and linguistic foundations for intelligent systems for sentiment analysis is not only relevant but also essential today.

Conclusions and Prospects for Further Investigations in the Mentioned Direction. In our view, the monitoring system, as it stands, is not yet perfect and requires some enhancements. For effective surveillance of potentially hazardous objects, a highly developed system of technical control is necessary. However, this is not always feasible due to significant financial expenditures. For instance, the existing forces and resources of the State Environmental Monitoring System of Ukraine (which includes the subsystem of medical-hygienic monitoring, water basin monitoring, air basin monitoring, geological environment monitoring, soil monitoring, and others) are involved in nationwide and territorial monitoring and laboratory control.

To enhance the accuracy and reliability of monitoring, we believe that combining intellectual, informational, and technological capabilities necessitates the use of one of the fundamental analysis methods widely employed in Opinion Mining for practical applications – Sentiment Analysis. This method is designed to detect emotional, evaluative judgments, and subjective attitudes towards any object, phenomenon, etc., expressed in textual information. One of the key tasks of Sentiment Analysis is the automatic assessment of various objects (individuals, media reports, events, organizations, etc.) within textual messages, through positive, negative, and neutral assessments, favorable and unfavorable opinions, quantitative indices, and more. We propose considering the potentially hazardous object as the subject of evaluation and ordinary citizens' reviews about the object on various social media platforms as the textual messages.

Thus, it has been established that the integration of intellectual, informational, and technological models enables the enhancement of operational alerts regarding potential or existing dangers through the utilization of information obtained from ordinary citizens and processed using Sentiment Analysis methods within the monitoring process.

References

1. Resolution of the Cabinet of Ministers of Ukraine dated January 16, 1996, No. 96 "On the Program for the Creation of the Government Information and Analytical System for Emergency Situations in 1996" [Electronic resource]. – Access mode: http://zakon1.rada.gov.ua/laws/show/96-96-п

2. Resolution of the Cabinet of Ministers of Ukraine dated December 16, 1999, No. 2303 "On the Creation of the Government Information and Analytical System for Emergency Situations" [Electronic resource]. – Access mode: http://zakon0.rada.gov.ua/laws/show/2303-99-%D0%BF

3. Resolution of the Cabinet of Ministers of Ukraine dated March 7, 2001, No. 215 "On the Establishment of the Coordination Council for the Creation and Functioning of the Government Information and Analytical System for Emergency Situations" [Electronic resource]. – Access mode: http://zakon1.rada.gov.ua/laws/show/215-2001-%D0%BF

4. Kropotov P.P., Begun V.V., Grechaninov V.F. Creation of a Modern Security Monitoring System - an Urgent State and Scientific Task / P.P. Kropotov, V.V. Begun, V.F. Grechaninov // Information Processing Systems. – 2015. Issue 11 (136). – P. 199-206.

5. Theoretical Justification for the Selection of Indicators, Variables, and Safety Monitoring Indicators / V.V. Begun, P.P. Kropotov, V.F. Grechaninov // Mathematical Machines and Systems. — 2018. — No. 1. — P. 90-100.

6. Andronov V.A., Dombrovska S.M., Semkiv O.M., Nazarenko V.Yu. Modern State of Organizational and Legal Support for State Management of Fire Safety in Ukraine: Monograph. Kharkiv, 2014. 230 p.

7. Kravtsiv S.Ya., Sobol O.M., Kosse A.G. Risk-Oriented Approach in State Regulation in the Field of Technogenic and Fire Safety / S.Ya. Kravtsiv, O.M. Sobol, A.G. Kosse // Bulletin of the National University of Civil Protection of Ukraine. Series: Public Administration. – 2017. – Issue 1 (6). – P. 336–341.

8. Law of Ukraine "On the State Targeted Program for the Protection of Population and Territories from Emergencies of Technogenic and Natural Origin for 2013-2017" // Verkhovna Rada of Ukraine, 2013, No. 19-20, art. 173 [Electronic resource]. – Access mode: http://zakon3.rada.gov.ua/laws/show/4909-17

9. Civil Protection Code of Ukraine [Electronic resource]. – Access mode: http://zakon1.rada.gov.ua/laws/show/5403-17/page4

10. Regulation on the Functional Subsystem of the Unified State System for Prevention and Response to Emergencies of Technogenic and Natural Origin "Security of Nuclear Power Facilities" [Electronic resource]. – Access mode: http://www.snrc.gov.ua/nuclear/uk/publish/article/140508

11. Grechaninov V.F. Recommendations for the Functioning of the Unified State Civil Protection System in Modern Conditions (First Edition) / Ukrainian Scientific Research Institute of Civil Protection. 2016. URL: http://undicz.dsns.gov.ua/files/2016/8/30/Persha_redakciya_rekomendaciy_EDSCZ.pdf (accessed on: October 13, 2019).

12. Basics of Civil Protection: Tutorial / O.V. Bykova, O. Ch. Boliiev, D.M. Derevynskyi, V.N. Yeliseiev, et al.; edited by M.V. Bolotskykh; State Emergency Service of Ukraine; Ukrainian University of Civil Protection; Institute of Public Administration in the Field of Civil Protection. Kyiv, 2008. 223 p.

13. On the Establishment of a Working Group on the Creation of the Situation Center of the Ministry of Defense of Ukraine: Order of the Minister of Defense of Ukraine dated January 20, 2012, No. 32 // Ministry of Defense of

Ukraine: official website. URL: http://www.mil.gov.ua/index.php?lang=ua&part=news&sub=read&id=23058 (accessed on: March 14, 2022).

14. Shvedun V.O., Ignatiev O.M. Improvement of State Management of Monitoring Potentially Dangerous Objects Using the European Procedure for Environmental Impact Assessment // Adaptation of Ukraine's Legal System to European Union Law: Theoretical and Practical Aspects: Materials of the V All-Ukrainian with International Participation Scientific-Practical Conference (Poltava, October 22, 2020): in 2 parts. Poltava: Rossava, 2020. P. 140–142.

15. On the Entry into Force of the Methodology for Observations on the Assessment of Radiation and Chemical Conditions: Order of the Ministry of Internal Affairs of Ukraine dated November 27, 2019, No. 986 // Database "Legislation of Ukraine" / Verkhovna Rada of Ukraine. URL: https://zakon.rada.gov.ua/laws/show/z0083-20#Text (accessed on: November 22, 2021).

16. On the Approval of the Regulation on the Organization of Notification of the Threat of Emergencies or the Occurrence of Emergencies and Communication in the Field of Civil Protection: Resolution of the Cabinet of Ministers of Ukraine dated September 27, 2017, No. 733 // Database "Legislation of Ukraine" / Verkhovna Rada of Ukraine. URL: https://zakon.rada.gov.ua/laws/show/733-2017-%D0%BF#Text (accessed on: February 21, 2022).

17. Response to Emergency Situations: Tutorial / O.G. Barylo, P.B. Volianskyi, S.O. Huriev, et al. Kyiv: Blank-Press, 2014. 210 p.

18. Ihnatiev O. State and Problems of the Information Mechanism of Public Management of Monitoring of the State of Potentially Dangerous Objects in Ukraine. Public Administration and State Security Aspects. 2022. Vol. 2/1. P. 138–149. DOI: 10.52363/passa-2022.1-14.

19. On the Approval of the Procedure for the Use of Information and Information and Telecommunication Systems and the Procedure for the Use and Accounting of Computer Programs: Order of the Head of the State Emergency Service of Ukraine dated July 19, 2019, No. 425. Kyiv: State Emergency Service of Ukraine, 2019.

20. Pang B., Lee L. Opinion Mining and Sentiment Analysis. Foundations and Trends in Information Re- trieval. 2. No. 1–2 (2008). P. 1–135.

21. SentiStrength [Электронный ресурс]: SentiStrength – sentiment strength detection in short texts. – Режим доступа: http://sentistrength.wlv.ac.uk/#About 28.11.2012

22. Thelwall M., Buckley K., Paltoglou G., Cai D., Kappas A. Sentiment strength detection in short informal text // Journal of the American Society for Information Science and Technology. 2010.