

Comparative analysis of the value-semantic sphere of Ukrainian volunteers using AI *

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Abstract

This work investigates the value orientations of groups and personalities of Ukrainian volunteers in wartime. The need to search for and substantiate new methodological tools that would make it possible to enrich the explanatory horizon of volunteering as a dynamic socio-psychological phenomenon that has significant developmental and social transformation potential. Big data analysis is a complex process for analysis. Therefore, this work uses elements of unsupervised learning, in particular data clustering, in order to highlight certain patterns in order to better assess the data obtained. The novelty lies in the development of approaches to clustering unstructured data related to the analysis of volunteer activities in Ukraine.

Keywords

deep learning, clustering, dig data, neural networks.

1. Introduction

The problem of psychological research of value orientations of an individual or group that implements volunteer activities acquires extraordinary relevance in conditions of full-scale invasion, since the support of systemic volunteering in conditions of social crises increasingly resembles professional activity, which is regulated by a series of laws and regulations on the one hand, and by a system of social norms, terminal and instrumental values, and the situation of actualization of volunteering as a canonical act on the other. This necessitates the search for and justification of the latest methodological tools that would make it possible to enrich the explanatory horizon of volunteering as a dynamic socio-psychological phenomenon that has a significant developmental and social transformational potential. At the same time, the coverage of the problem under study requires correct methodological optics that would synthesize both psychological and technical means of collecting, processing and interpreting information. Therefore, the methodological basis of the current study is: a) the theory of action of V.A. Roments; b) methodological optics of the non-classical type of scientific rationality; c) psychological detailing as a logical-methodological procedure. (not necessarily in this sequence, it would also be nice to add some technical methodological aspects)

At the same time, the methodological toolkit for implementing the study consists of two complementary methods of cognition, namely: a) psychodiagnostic, involves the use of such methods as the Volunteer Functions Inventory (VFI) and the Portrait Values Questionnaire (PVQ), which are designed to identify individual psychological features of the value-meaningful sphere of the volunteer's personality, which is the initial prerequisite for the emergence of motivation to transform the environment (situation) by committing prosocial, moral actions.

The use of artificial intelligence in the analysis of human behavior is becoming increasingly critical in the modern data-driven world. This field combines advanced AI technologies with

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behavioral science to derive meaningful insights from vast amounts of human activity data, offering unprecedented opportunities to understand and predict human behavioral patterns.

AI systems excel at simultaneously processing and analyzing multiple streams of data, including social media activity, online shopping behavior, physical movement patterns, and communication styles. Using sophisticated machine learning algorithms, these systems can detect subtle patterns and correlations that may be invisible to the human eye. Deep learning models can process unstructured data such as video, voice recordings, and text messages to understand emotional states, intentions, and decision-making processes.

The novelty lies in the development of approaches to clustering unstructured data related to the analysis of volunteer activities in Ukraine.

The practical value lies in the software implementation of the data clustering module.

2. Literature review

The research [1] explores the integration of artificial intelligence (AI) in K-12 education, highlighting its applications in personalized learning, automated assessment, and facial recognition for behavioral analysis. The study also identifies ethical concerns, such as algorithmic bias and social inequalities, and emphasizes the need for AI literacy among teachers and students. The study [2] examines the current state of Remote Patient Monitoring (RPM) systems and the integration of artificial intelligence in healthcare monitoring applications. Their analysis reveals how AI-enabled RPM architectures have improved healthcare through early detection of health deterioration and personalized monitoring using advanced learning techniques. In work [3] authors highlights the role of artificial intelligence (AI) in therapy, emphasizing its ability to analyze large datasets and provide valuable insights. AI helps in detecting current and potential issues and evaluating predictions and solutions. The goals of cognitive computing psychology align with AI's purpose of understanding human cognition, using advanced technology to model cognitive processes. Despite differences between computational modeling and AI, both are crucial for advancing cognitive science by offering insights into intelligent thought. In [4], the authors present an interdisciplinary framework designed to monitor, track, and analyze human behavior during activities of daily living (ADLs), with a focus on detecting abnormal behaviors that may indicate emergencies. The framework's two main functionalities, including the semantic analysis of user interactions and an intelligent decision-making algorithm, were tested on a dataset and achieved performance accuracies of 76.71% and 83.87%, respectively, demonstrating its potential to improve the quality of life for the aging population in smart homes and other IoT-based environments. This study [5] introduces collaborative generative agents using Large Language Models (LLMs) for task-oriented social simulations. Evaluating these agents in a simulated job fair, the study highlights their ability to mimic human-like behavior and solve tasks. Despite promising results, limitations in more complex coordination tasks are identified, offering insights into the potential of LLMs for future simulations. In paper [6], the authors explore the integration of ChatGPT, a generative AI tool, into social psychology research, discussing its potential benefits in analyzing textual data, modeling social interactions, and advancing human behavior insights. They emphasize the importance of addressing ethical, theoretical, and methodological challenges while offering recommendations for the responsible use of ChatGPT, including managing biases, ensuring privacy, and maintaining transparency in data interpretation. The study [7] investigates the impact of artificial intelligence (AI) on decision-making, laziness, and privacy concerns among university students in Pakistan and China, highlighting its growing role in the education sector. The findings reveal that AI significantly contributes to increased laziness, privacy issues, and a loss of decision-making abilities, with human laziness being the most affected, emphasizing the need for preventive measures before AI implementation in education. In [8], authors reviews research on volunteer motivation from 2000 to 2021, using bibliometric analysis to explore trends, authors, countries, and institutions in the field. The findings reveal a clear framework for volunteer motivation research, highlighting the impact of collectivism on Chinese volunteers and individualism on American volunteers, and providing valuable insights for future studies. In work [9], the authors explore the classic grounded theory approach in social sciences, focusing on how it generates theories grounded in the real-life experiences and behaviors of individuals. The study examines the strengths and challenges of applying grounded theory to understand human behavior,

while addressing its ontological, epistemological, and methodological foundations. The research [10] examines how digital technologies, such as social networks, gamification, chatbots, and AI, improve the recruitment process. It uses a case study approach with tools like LinkedIn, Udacity, L'Oréal's Reveal game, TextRecruit's Ari, and Randstad.tech's data system. The study highlights how these tools work together to transform recruitment and offers recommendations for recruiters adopting e-recruitment. The study [11] provides an integrated view of AI research in marketing, consumer research, and psychology, identifying eight key clusters: decision-making, neural networks, machine learning, social media analytics, and more. It highlights 412 theories, including game theory and the theory of mind, and discusses the rapid growth of AI publications. The study also proposes a cross-disciplinary research agenda to further explore AI's potential. The review [12] examines AI and deep learning in psychological interventions and diagnosis, showing promising effects on clinical outcomes. However, further research with larger sample sizes and long-term studies is needed. The article [13] discusses AI's history, advancements, and future, focusing on its relationship with humans. AI is expected to drive future revolutions, though challenges may arise if expectations aren't met. This paper [14] surveys AI's impact on fundamental sciences like mathematics, medicine, and physics. It explores challenges in each field and AI's potential solutions. It also discusses the need for robust ML systems and lifelong learning to address security risks and performance decline. In work [15], the authors provide a comprehensive review of artificial intelligence development, focusing on its technological scope, applications, and integration across various industries. The study presents a systematic overview of AI's current state, examining its core techniques, development prospects, and challenges while offering valuable insights for both researchers and practitioners. In [16], the authors demonstrate how Artificial neural networks (ANNs) have been successfully applied to various complex tasks, such as image recognition and speech processing. In paper [17], the authors highlight the effectiveness of Convolutional neural networks (CNNs) in automatically learning hierarchical features, which makes them powerful tools for object recognition, face detection, and other image-based tasks. The works [18-20] provide an analysis of the use of artificial intelligence tools in data analysis. Examples of the use of intelligent systems and ontology are discussed in the work [21-22].

3. Problem statement

To analyze the behavior of volunteers using artificial intelligence, it is necessary to perform the following tasks:

- develop a questionnaire based on two methods;
- analyze artificial intelligence algorithms for analyzing unstructured data;
- implement clustering algorithms and analyze the results;

4. Methodology

Volunteer Functions Inventory (VFI)

Developed in 1998 by authors from the American Psychological Association, who applied functionalist theory to the question of the motivation underlying volunteering, hypothesized 6 functions that volunteering potentially performs and developed a tool for assessing them. The motivation for the creation, as indicated by one of the authors (Latham, 2012), is Maslow's theory of needs and the active emergence of volunteer organizations and initiative groups in the United States after World War II. The questionnaire can be considered one of the most valid, according to the analysis of subsequent scientists, in particular, one of the largest systematic reviews from the University of Madrid (Fernando Chacón, Gema Gutiérrez, Verónica Sauto, María Luisa Vecina and Alfonso Pérez, 2017) confirmed the acceptance criteria of 72% of the studies based on this questionnaire.

VFI is a universal research tool and allows to partially level out the peculiarities of the mentality of people engaged in volunteer activities, as indicated by its use in modern developments around the world. Despite this, a number of scientists express an opinion about the incompleteness of

information and factors of formation of the semantic sphere of a modern volunteer, which can be covered by a questionnaire (Law et al., 2011; Phillips & Phillips, 2011; Shye, 2010). In order to carry out a more thorough multiple analysis of additional functions of the value-semantic sphere in field conditions and to search for correlations with those that allow to find VFI, auxiliary tools are used.

Schwartz's Portrait Values Questionnaire (PVQ) Methodology,

Developed in 1992 by American professor and ARA member Shalom Schwartz, the theory of Basic Human Values aims to distribute human values into a multi-level structure, compromising them into 10 different meanings that allow us to distinguish general concepts of the value-semantic sphere of a person. Based on the theory in the same year, the scientist creates a questionnaire, which over time expanded the number of questions from 21 to 40. Its uniqueness lies in the approach to measuring values through descriptions of behavioral manifestations typical of certain values, which allows minimizing the influence of social desirability and providing a more accurate understanding of the respondent's motivational attitudes.

The questionnaire has been tested in cross-cultural studies in over 80 countries (Schwartz, 2012). Today, the questionnaire has gone beyond the scientific environment and has become not only a basic tool of the psychodiagnostic toolkit, but is also actively used by popular science and entertainment platforms. More than 25 published studies using the methodology have been recorded in Ukraine, in particular, the domestic scientist I. Semkiv adapted the methodology, which we also use in this work.

5. Data processing approaches

Artificial intelligence (AI) is one of the most transformative technological advances in human history. The field was officially born in 1956 at the Dartmouth Conference, where leading computer scientists laid the foundations for AI research. Since then, AI has evolved from simple rule-based systems to complex learning algorithms capable of processing vast amounts of data and performing complex tasks. The core components of AI include several interrelated technologies and methodologies. Machine learning (ML) forms the foundation of modern AI, allowing systems to learn from experience without explicit programming. Deep learning, a subset of ML, uses artificial neural networks inspired by the human brain to process data through multiple layers, enabling complex pattern recognition. Natural language processing (NLP) allows machines to understand, interpret, and generate human language, while computer vision allows AI systems to analyze and understand visual information from the world around them. The application of AI in behavioral analytics spans a variety of sectors. In marketing, it helps companies understand consumer preferences and predict purchasing decisions by analyzing browsing patterns, social media interactions, and purchase history. In healthcare, AI systems monitor patient behavior to detect early signs of mental health issues or cognitive decline. Security systems use AI to detect suspicious behavior patterns and potential threats in public places. In education, AI analyzes student engagement and learning patterns to personalize educational content and teaching methods. One of the most important advantages of AI in behavioral analytics is its ability to process data in real time and provide instant insights. This capability allows for rapid response to changing behavioral patterns and dynamic adjustment of intervention strategies. For example, online platforms use AI to detect and respond to user engagement levels in real time, adjusting content delivery to maintain user interest and satisfaction.

Data reduction is an important process in data science and information management that aims to reduce the volume of data while preserving its integrity and essential characteristics. This approach is particularly important in the era of big data, when organizations face challenges in storing, processing, and efficiently analyzing large amounts of information.

The process of data reduction includes several key methods and techniques. First, dimensionality reduction methods, such as principal component analysis (PCA), linear discriminant analysis (LDA), and t-SNE, help minimize the number of random variables considered. These methods transform complex, multidimensional data sets into more compact representations while preserving important patterns and relationships in the data.

Another important aspect of data reduction is compression, which uses both lossless and lossy methods. Lossless methods, such as Run-Length Encoding and Huffman Coding, allow the original data to be fully recovered from its compressed version. Lossy methods, on the other hand, sacrifice some data accuracy, but provide a higher level of compression and are particularly useful for multimedia formats such as images, audio, and video.

Linear regression is one of the main statistical methods of data analysis, which is designed to establish a direct relationship between a dependent and independent variable. Its origins date back to the work of Francis Galton in the 19th century, and this method has become an important tool for forecasting, prediction, and analyzing relationships in various fields.

6. Experiments and Results

Visualization of statistical data by the questionnaire criterion “I care about those who are less fortunate than me”, “Volunteering can help me get a job”, “I sincerely care about a specific group” is shown in Figure 1.

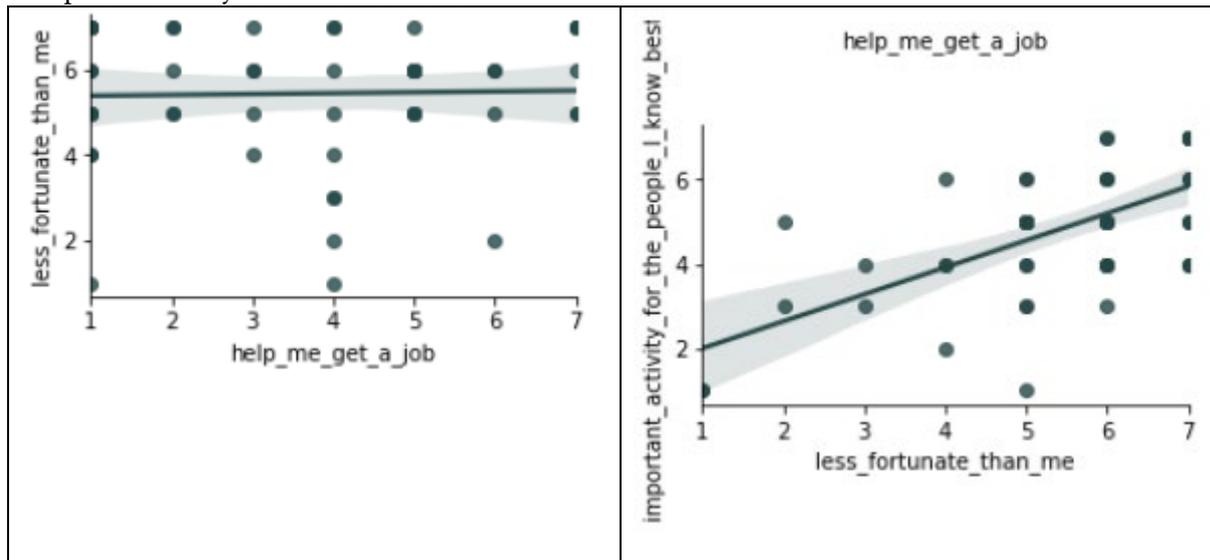


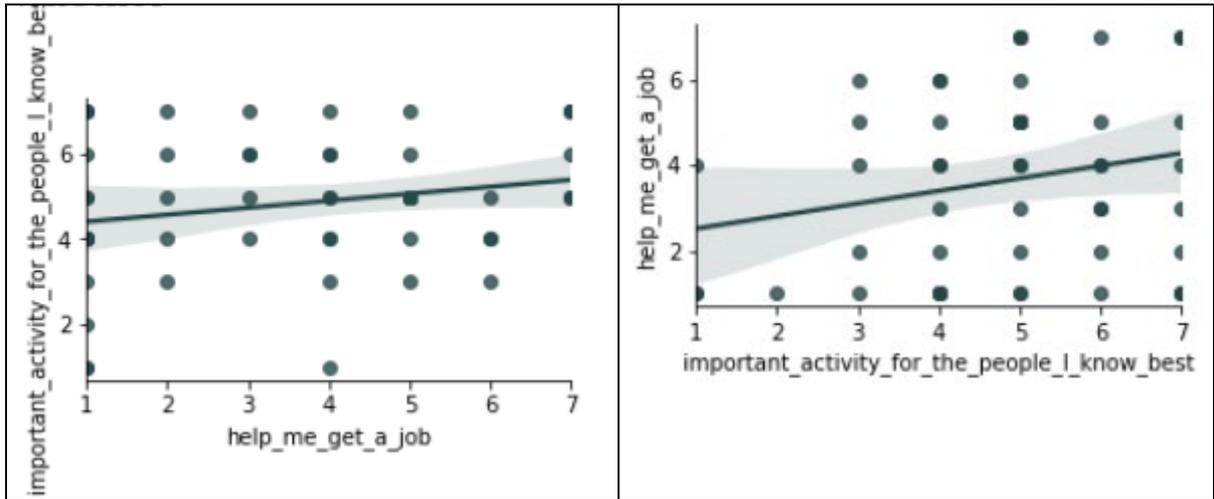
Figure 1: Visualization of statistical data

Table 1 presents a comparative analysis of the results obtained according to the criteria “Volunteering can help me get a job”, “I care about those who are less fortunate than me”, “Volunteering is an important activity for the people I know best”.

Table 1

Comparative analysis of the results obtained





The curve demonstrating the optimal number of clusters is shown in Figure 2.

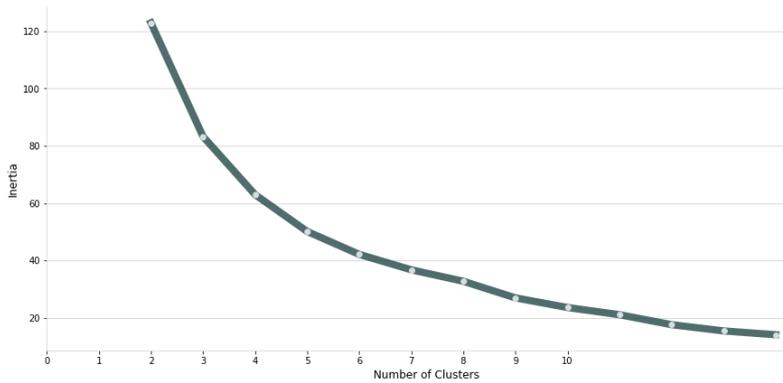


Figure 2: Curve describing the optimal number of clusters

An important element in clustering is the measurement of the density and separation of clusters. Visually, the Silhouette coefficient is shown in Figure 3.

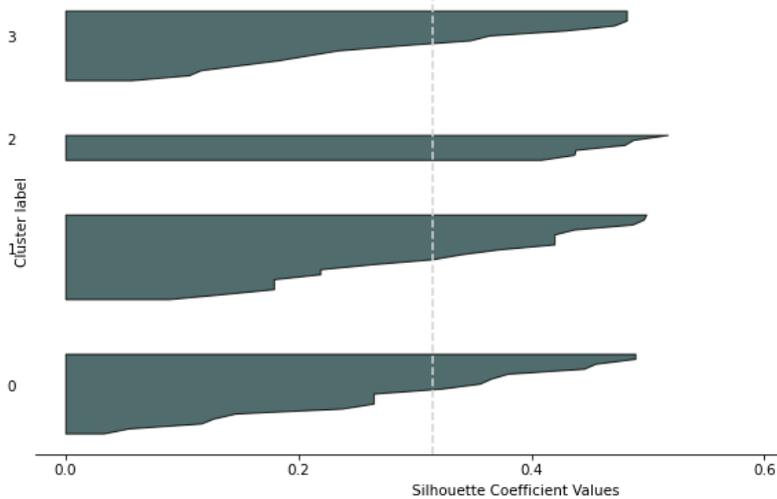


Figure 3: Silhouette coefficient

An example of 3D visualization for 6 clusters is shown in Figure 4.

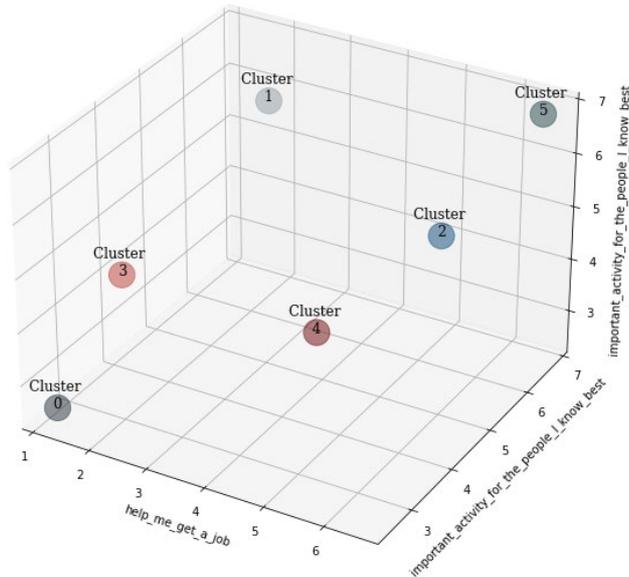


Figure 4: Visualisation of the 6 clusters

- Cluster 0 – high level of interest in finding new friends, low level of interest in finding a job
- Cluster 1 – importance in activities approved by friends, desire to help people who have less.
- Cluster 2 – high level of loneliness, high level of expectation of success in professional activities
- Cluster 3 – low level of loneliness, high level of interest in the group in which the person is
- Cluster 4 – medium level of loneliness, medium level of expectation of success in professional activities
- Cluster 5 – possibility of getting the expected job,

Method 2

Visualization of statistical data according to the questionnaire criterion “It is important for him/her that all people in the world are considered equal. Believes that every person should have equal chances in life”, “He/she likes to decide for himself what to do. It is important for him/her to be free in planning and choosing his/her activities”, “The security of his/her country is important for him/her. The person believes that the state should be on guard against internal and external threats” is shown in Figure 1.

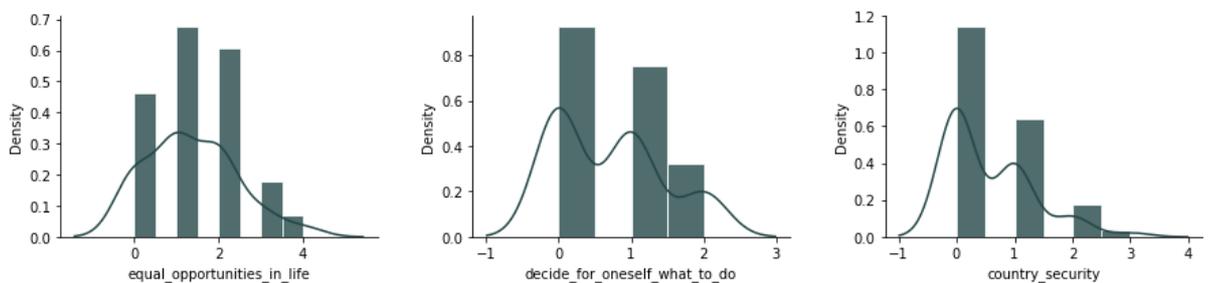
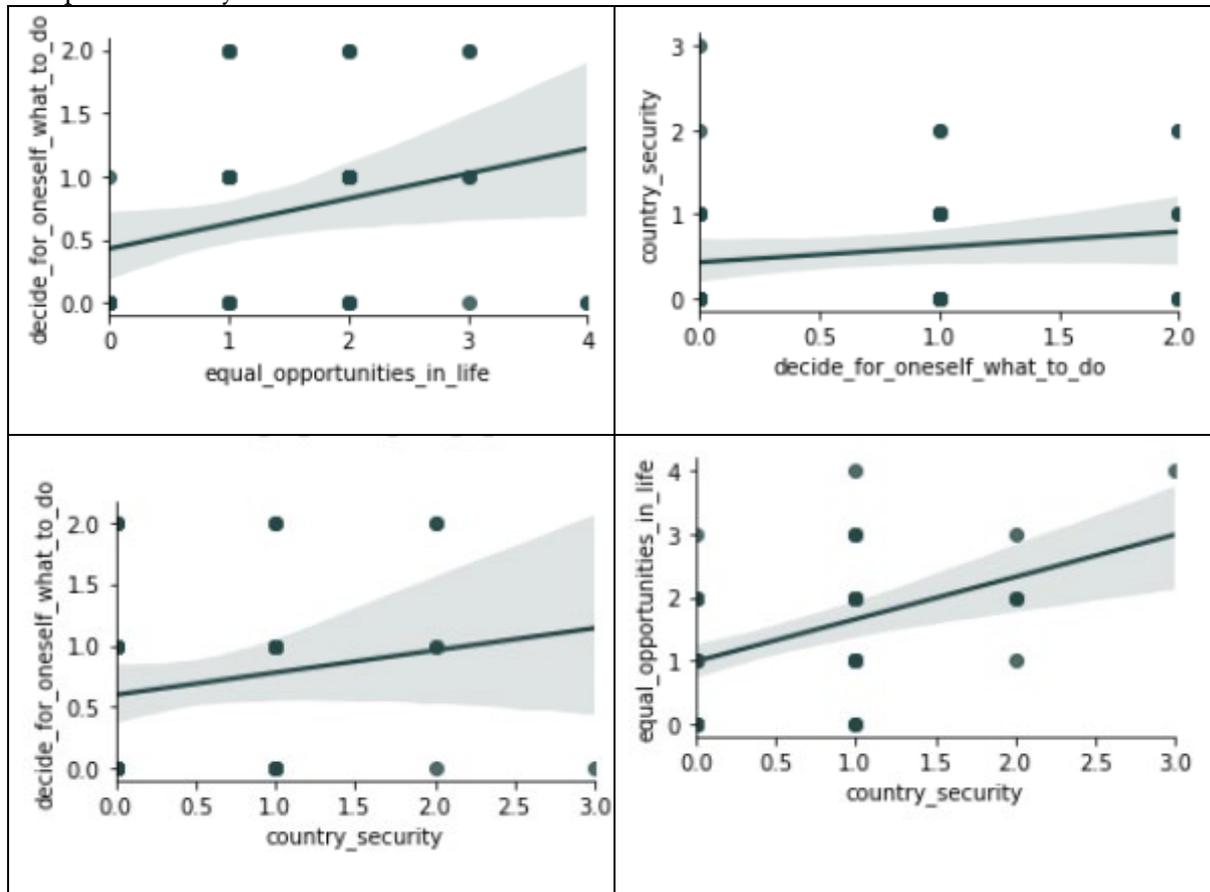


Figure 5: Visualization of statistical data

Table 1 presents a comparative analysis of the results obtained according to the criteria “It is important for him/her that all people in the world are considered equal. Believes that every person should have equal chances in life”, “He/she likes to decide for himself what to do. It is important for him/her to be free in planning and choosing his/her activities”, “The security of his/her country is

important for him/her. The person believes that the state should be on guard against internal and external threats”.

Table 2
Comparative analysis of the results obtained



An example of 3D visualization for 6 clusters is shown in Figure 4.

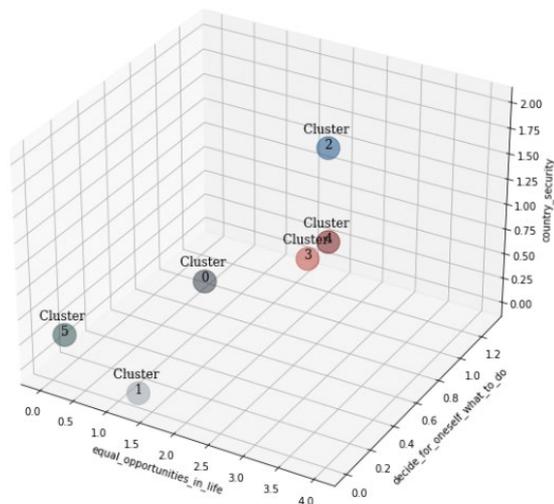


Figure 6: 3D visualization

- Cluster 0 – the need for security of the individual
- Cluster 1 – the importance of activities that are approved by friends, the desire to help people who have less.
- Cluster 2 – self-realization, the average level of the need to ensure equality between people
- Cluster 3 – the need to ensure material well-being
- Cluster 4 – a high level of self-realization
- Cluster 5 – a low level in the issue of material enrichment

7. Conclusions

In this work:

- A questionnaire was developed based on methods for surveying Ukrainian volunteers
- An analysis of artificial intelligence tools for processing unstructured data was carried out.
- A comparative analysis of the obtained data was carried out based on clustering algorithms, which allowed us to identify clusters and carry out their description and analysis to search for non-obvious dependencies

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Declaration on Generative AI

The authors have not employed any Generative AI tools.

References

- [1] Akgun, S., Greenhow, C. Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI Ethics* 2, 431–440 (2022). <https://doi.org/10.1007/s43681-021-00096-7>
- [2] Thanveer Shaik, Xiaohui Tao, Niall Higgins, Lin Li, Raj Gururajan, Xujuan Zhou, U. Rajendra Acharya . Remote patient monitoring using artificial intelligence: Current state, applications, and challenges - *Wires. Data mining and knowledge discovery* - Volume13, Issue2 March/April 2023 e1485 - <https://doi.org/10.1002/widm.1485>
- [3] Chhabra, G., Kumar, S., Gupta, S., Nagpal, P. (2023). Artificial Intelligence for Understanding Human Behavior and Psychology. In: *Artificial Intelligence to Analyze Psychophysical and Human Lifestyle*. Springer, Singapore. https://doi.org/10.1007/978-981-99-3039-5_2
- [4] Thakur, Nirmalya, and Chia Y. Han. 2021. "An Ambient Intelligence-Based Human Behavior Monitoring Framework for Ubiquitous Environments" *Information* 12, no. 2: 81. <https://doi.org/10.3390/info12020081>
- [5] Yuan Li, Yixuan Zhang, Lichao Sun MetaAgents: Simulating Interactions of Human Behaviors for LLM-based Task-oriented Coordination via Collaborative Generative Agents <https://doi.org/10.48550/arXiv.2310.06500>
- [6] Salah, Mohammed, Hussam Al Halbusi, and Fadi Abdelfattah. "May the force of text data analysis be with you: Unleashing the power of generative AI for social psychology research." *Computers in Human Behavior: Artificial Humans* 1, no. 2 (2023): 100006. <https://doi.org/10.1016/j.chbah.2023.100006>
- [7] Ahmad, S.F., Han, H., Alam, M.M. et al. Impact of artificial intelligence on human loss in decision making, laziness and safety in education. *Humanit Soc Sci Commun* 10, 311 (2023). <https://doi.org/10.1057/s41599-023-01787-8>
- [8] Chen J, Wang C and Tang Y (2022) Knowledge Mapping of Volunteer Motivation: A Bibliometric Analysis and Cross-Cultural Comparative Study. *Front. Psychol.* 13:883150. doi: 10.3389/fpsyg.2022.883150

- [9] Mohajan, Devajit and Mohajan, Haradhan (2022): Classic Grounded Theory: A Qualitative Research on Human Behavior. Published in: *Studies in Social Science & Humanities* , Vol. 3, No. 1 (26 December 2022): pp. 1-7.
- [10] Allal-Chérif, Oihab, Alba Yela Aránega, and Rafael Castaño Sánchez. "Intelligent recruitment: How to identify, select, and retain talents from around the world using artificial intelligence." *Technological Forecasting and Social Change* 169 (2021): 120822. <https://doi.org/10.1016/j.techfore.2021.120822>
- [11] Mariani, Marcello M., Rodrigo Perez-Vega, and Jochen Wirtz. "AI in marketing, consumer research and psychology: A systematic literature review and research agenda." *Psychology & Marketing* 39, no. 4 (2022): 755-776.
- [12] Zhou S, Zhao J and Zhang L (2022) Application of Artificial Intelligence on Psychological Interventions and Diagnosis: An Overview. *Front. Psychiatry* 13:811665. doi: 10.3389/fpsyt.2022.811665
- [13] Jiang, Y., Li, X., Luo, H. et al. Quo vadis artificial intelligence?. *Discov Artif Intell* 2, 4 (2022). <https://doi.org/10.1007/s44163-022-00022-8>
- [14] Xu, Yongjun, Xin Liu, Xin Cao, Changping Huang, Enke Liu, Sen Qian, Xingchen Liu et al. "Artificial intelligence: A powerful paradigm for scientific research." *The Innovation* 2, no. 4 (2021).
- [15] I. Paliy, A. Sachenko, V. Koval and Y. Kurylyak, "Approach to Face Recognition Using Neural Networks," 2005 IEEE Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, Sofia, Bulgaria, 2005, pp. 112-115, doi: 10.1109/IDAACS.2005.282951.
- [16] Zhang, Caiming, and Yang Lu. "Study on artificial intelligence: The state of the art and future prospects." *Journal of Industrial Information Integration* 23 (2021): 100224. <https://doi.org/10.1016/j.jii.2021.100224>
- [17] Roza Dastres, Mohsen Soori. Artificial Neural Network Systems. *International Journal of Imaging and Robotics (IJIR)*, 2021, 21 (2), pp.13-25. <hal-03349542>
- [18] Taye, Mohammad Mustafa. 2023. "Theoretical Understanding of Convolutional Neural Network: Concepts, Architectures, Applications, Future Directions" *Computation* 11, no. 3: 52. <https://doi.org/10.3390/computation11030052>
- [19] Berezsky, O., Pitsun, O., Datsko, T., Tsmots, I., Teslyuk, V. Specified diagnosis of breast cancer on the basis of immunogistochemical images analysis. *CEUR Workshop Proceedings, 2020, 2753*, pp. 129–135 <https://ceur-ws.org/Vol-2753/short5.pdf>
- [20] Berezsky, O., Pitsun, O., Batryn, N., ... Berezska, K., Dubchak, L. Modern automated microscopy systems in oncology *CEUR Workshop Proceedings, 2018, 2255*, pp. 311–325 <https://ceur-ws.org/Vol-2255/paper28.pdf>
- [21] Berezsky, Oleh, Oleh Pitsun, Grygoriy Melnyk, Tamara Datsko, Ivan Izonin, and Bohdan Derysh. 2023. "An Approach toward Automatic Specifics Diagnosis of Breast Cancer Based on an Immunohistochemical Image" *Journal of Imaging* 9, no. 1: 12. <https://doi.org/10.3390/jimaging9010012>
- [22] Striuk, O., & Kondratenko, Y. (2021). Generative Adversarial Neural Networks and Deep Learning: Successful Cases and Advanced Approaches. *International Journal of Computing*, 20(3), 339-349. <https://doi.org/10.47839/ijc.20.3.2278>
- [23] Fedasyuk, D., & Lutsyk, I. (2023). Approach to Implementation of Configuration Process for Adaptive Software Systems based on Ontologies. *International Journal of Computing*, 22(3), 381-388. <https://doi.org/10.47839/ijc.22.3.3234>
- [24] V. Brych, V. Manzhula, N. Halysh, N. Kalinichuk, N. Reznik and I. Hrynychak, "Modeling the Dynamics of Living Standards Based on Factors of the Remuneration System," 2021 11th International Conference on Advanced Computer Information Technologies (ACIT), Deggendorf, Germany, 2021, pp. 420-423, doi: 10.1109/ACIT52158.2021.9548617.