AUTOMATED DETERMINATION OF A BEHAVIORAL PERSONALITY TYPE USING THE DISC METHOD: COMPARATIVE RESEARCH OF PROGRAMS AND CHATBOTS BASED ON ARTIFICIAL INTELLIGENCE

Vasily Kashkin, PhD, Associate Professor of the American University of Phnom Penh

Valeriya Paliy, BS, Masters student of the Rostov State University of Economics

Abstract. The article presents the results of the comparative research and testing of programs and chatbots based on artificial intelligence in order to determine the type of client's personality using the DISC method. As part of the study, a preliminary selection of text analytics programs with psychometric analysis functions, as well as available chat bots, was carried out. A literature review on this topic is presented. As a result of the study, it was possible to identify programs that are able to determine the type of a person's personality and evaluate their comparative effectiveness.

Keywords: personality type, DISC, artificial intelligence, text analysis, chatbot, personalized marketing.

Introduction

One of the trends of modern marketing is personalization. It is part of a marketing strategy in which a business creates individual and personalized offers for each consumer. Personalization can be the selection of a product or service for sale, the creation of a mailing list and a collection in a catalog, etc.

To implement personalized marketing, it is necessary to understand which consumers we plan to work with, for this it is important to know their psychometric characteristics. Business does not always have the opportunity to hire professional psychologists to work with clients; besides, the traditional "manual" determination of psychological personality traits is quite laborious and time-consuming, and cannot be carried out in the absence of direct contact with the consumer. It is also possible to assess the personality of the client with the help of special psychological tests, but they also require contact with the consumer.

Programs that have the functions of automated personality assessment based on psychological methods are capable of solving this problem. Such programs include automated text analytics, thanks to which, from the text written by a particular person, it is possible to extract important information about his/her psychological traits. This information will allow the business to improve the product or method of its promotion so that this product is most useful for the client.

The purpose of this study is to draw conclusions about the effectiveness of such programs and the possibility of their use in practice.

Methods and information base

We analyzed 62 text mining programs and 11 artificial intelligence chatbots using automated language models (Table 1).

Table 1. Text mining programs and chatbots studied in the study

AUTOMATED DETERMINATION OF A BEHAVIORAL PERSONALITY TYPE USING THE DISC METHOD

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	Crystal	S	Audience
SparkToro	Receptiviti		
Chatbots based on language models			

Source: developed by the authors

Analysis of the functions of the presented programs revealed only a few programs capable of performing psychometric text analysis. A list of such programs is presented in the *Preliminary selection of programs paragraph* with a detailed description of their functions.

In order to draw a conclusion about the effectiveness of programs, it is necessary to test them on a real example. For this purpose, texts from a key top manager and financial director of one of the leading IT companies in China were selected. The sources of information for testing the programs were his page on the social network LinkedIn, posts he wrote, as well as materials of conferences and speeches. All texts are published in the public domain, from the first person. Thus, for external analysis, we put ourselves in the shoes of a company that wants to establish new business ties with such a business leader, and for this we study information about him from open sources.

Six pages of text were analyzed: 1,356 characters in English and 5,377 characters in Chinese.

As a psychological technique that will be used to determine the type of personality of this leader, we have chosen the DISC method, which evaluates the following personality parameters: dominance, influence, steadiness, consciousness. In our opinion, this model is quite simple for application and analysis, does not require psychological education, and is also useful for determining the dominant features of a person. Its use can be considered productive for marketing and business purposes.

Literature review

The use of text to determine a person's personality type on the basis of artificial intelligence and machine learning is covered in research publications by authors such as Eva Lahuerta-Otero, Rebeca Cordero-Gutiérrez [1], Fatemeh Mohades Deilami, Hossein Sadr, Mozhdeh Nazari [2], Basant Agarwal [3], Kai Yang, Raymond Y. K. Lau, Ahmed Abbasi [4].

A literature review by Hussain Ahmad, Muhammad Zubair Asghar, Alam Sher Khan, and Anam Habib showed that between 2007 and 2019, at least 30 papers were published on determining the type of human personality through textual content, the main source of which is social media [5]. The authors of the study *Personality Research and Assessment in the Era of Machine Learning* mention the text as one of the sources of automated study of personality type [6]. The authors of the study *Using Machine Learning to Advance Personality Assessment and Theory* also believe that text data generated by users of social networks (messages, posts, statuses) can be processed using automated text analysis programs for further personality research [7]. The same opinion is shared by the authors of the study *Personality Classification from Online Text using*

Machine Learning Approach [8]. The work *Emotional Speech-based Personality Prediction Using NPSO Architecture in Deep Learning* states that personality characteristics can be determined through resources such as text, social networks, while the DISC model is mentioned as one of the models for personality assessment [9]. In the study *Personality Prediction with Social Behavior by Analyzing Social Media Data – A Survey*, the linguistic approach is considered as one of the ways to determine personality traits using social network data [10]. The research of AI chatbots *How Well Can an AI Chatbot Infer Personality? Examining Psychometric Properties of Machine-inferred Personality Scores* showed that chatbots can quite reliably determine psychometric personality characteristics, even better than traditional assessment. This study is unique in its kind [11].

It is worth noting that in most articles on automated text analysis, Big-5 (OCEAN) is called as the main method for determining the type of personality. In our opinion, this model has limited potential for marketing and business communication purposes.

Preselection of programs

To analyze the initial data in order to determine personal characteristics, we conducted a preliminary selection of programs that support the function of automated text analysis and are capable of performing psychometric analysis.

Humantic AI runs as an extension in Google Chrome browser. In order to start analyzing a person's profile, you need to go to the page of the person of interest on LinkedIn and launch the program extension. Humantic AI analyzes a person's profile, description, posts, interests and automatically determines the type of personality and its inherent behaviors. DISC and Big-5 methods are used to determine the type of personality.

Crystal analyzes a person's profile, you can carry out the analysis from your personal account by inserting a link to the page on LinkedIn, or go to the person's page and open the browser extension. The program analyzes posts, a description of a person, interaction with other people, and conducts psychological tests based on these data. The program promises to predict a person's personality type and give advice on how best to contact him. It lets you know which words, phrases, type of speech and tone to use or avoid when communicating with him. To determine the type of personality, the DISC technique is used.

Symanto AI is a program that offers automated text analysis for in-depth understanding of consumers and is designed to analyze their feedback on a brand and product. For analysis, it is necessary to load the texts of reviews into the program. As one of the functions of the program, the definition of psychometric data according to the theory of personality traits of Carl Gustav Jung.

The web version of **LIWC** is designed to analyze passages of text and allows you to determine the ratio of the linguistic characteristics of a passage with the average values of these characteristics for the declared type of text. Among these characteristics are the number of possessive pronouns (I, me, mine, etc.), positive / negative tone, words about society, the level of cognitive processes, the level of charm and morality, as well as the level of analytical thinking and the level of honesty.

Audience is a program for analyzing the target audience, which allows, based on the description of the audience, to find out its demographic and socio-economic characteristics, interests, as well as a psychological portrait. The information is presented in an aggregated form based on social media data and helps to learn new information about various segments of the target audience of the business.

SparkToro works in a similar way and collects aggregated data from social networks about the interests and behavior of the target audience on social networks and the Internet.

Receptiviti allows you to extract information about the psychological portrait, personality and emotions of the author from any text, but does not provide free access to test accounts.

Among the presented text analysis programs with psychometric functions, only Crystal and Humantic AI have the ability to determine the type of a particular personality based on the DISC methodology, so they were selected for further testing as part of the study.

On the other hand, in addition to specialized programs, it is possible to use chatbots based on artificial intelligence. Such chatbots work in a similar way: you need to add any request in the text input window, and the chatbot will present its answer to it. The difference in chatbots lies in different language models, work patterns, learning levels, and the knowledge base of artificial intelligence. Notable chatbots that can be freely accessed include: **ChatGPT, Bard, ChatSonic, Rytr, Neeva, Perplexity, OpenAI playground, Elicit, Microsoft Bing, Open Assistant, Bearly.ai.**

We did a preliminary test of the presented chatbots by sending a request that included the task of determining the type of personality from the texts of chosen leader, as well as a link to his LinkedIn account. The following results were obtained.

A number of chatbots were unable to complete the task of determining the type of personality using the DISC method, neither by text nor by account, including ChatSonic, Rytr, Perplexity, Elicit, Microsoft Bing, Bearly.ai. At the same time, Elicit can search for texts and articles on the Internet, but cannot independently analyze the text.

Several chatbots are designed for other purposes and are more complex models. So, Neeva is no

longer a standalone search engine and chatbot, but a complex developer platform that requires SQL queries, not text input. Open AI playground is the original version of ChatGPT, which provides links to this bot, artificial intelligence for creating images, and an API for developers to create their own chatbots.

3 1 5 1 0   As a result, only three chatbots received a positive personality type test: ChatGPT, Bard, and Open Assistant. All three models are chatbots that use artificial intelligence to recognize natural language and generate human-like text.

Program testing

Thus, for further testing, we selected Crystal and Humantic AI programs and ChatGPT, Bard and Open Assistant chatbots.

Direct testing of programs includes determining the personality type of the chosen leader using the DISC method, the severity of each of the personality traits, generating a personality description and assessing the degree of reliability.

So, Crystal and Humantic AI work in a similar way: you need to add a link to the analyzed person on LinkedIn to the program. To obtain a more accurate result in Humantic AI, it is also possible to download texts written by the analyzed person. After we carried out these actions, the programs provided the necessary data on the type of personality, on the severity of personality traits, as well as factors of motivation, oppression, etc.

To test the chatbots, they were asked the following queries:

1. Determine the personality type of the person who maintains the account through this [link] using the DISC method.

2. Determine the personality type of the person who wrote these [texts] using the DISC method.

3. Assess the severity of each personality trait according to the DISC methodology, using the "high, medium, low" scale or as a percentage.

4. Assess the reliability of your estimate.

5. Describe this person with only adjectives.

6. Describe this person.

The test results are presented in Table 1. It is worth noting that Crystal, Humantic AI and Bard chatbot were able to assess the type of personality using only a link to a LinkedIn account. At the same time, Humantic AI and Bard were able to improve the accuracy of the assessment by combining it with the assessment based on the texts of this person. Text-only assessment is possible only in ChatGPT, Bard and Open Assistant, while ChatGPT and Open Assistant cannot analyze the type of personality using a LinkedIn account link. In addition, only the programs Humantic AI and ChatGPT could recognize Chinese in addition to English text.

Table 2. Results of testing programs and chatbots

	Crystal	H	ChatGPT	Bard	Open Assistant
Archetype	Captain (D)	Critic (Cd)	Captain (D)	Motivator (I) by LinkedIn Dominant (D) by texts	Dominant (D)
The severity of D - dominance		Low	High	High	High
The severity of I - influence		Low	Medium	Medium	High
The severity of S - steadiness		Low	Low	Low	Medium
The severity of C - consciousness		High	Low	High	High
Estimation Reliability					
Method of assessment	Based on your LinkedIn profile	Based on LinkedIn profile + uploaded texts	Text based	Based on LinkedIn profile + uploaded texts	Text based
Description of the person in adjectives	Straight Devoted Dynamic	Critical Profit Oriented Accurate	Confident Purposeful Determined Ambitious	Straight Assertive Result Oriented Competitive Decisive Confident Ambitious Managed Purposeful	For external-internals (High D): dynamic, realistic, open, active, energetic, confident, stable, planning, managing. For internal-internals (Low S): balanced, flexible, patient, relaxed, calm, benevolent, passive and managerial

Description of personality	This leader is likely to be an enterprising and straightforward leader. His natural ambition and self-sufficiency can help him work on his own towards a big goal or effectively guide others to success.	He enjoys working alone and does not rely on others very often. He prefers logical analysis and values facts more than emotions. He does not appreciate brilliant effects if there is no data behind them.	The author shows high activity and initiative, desire for leadership and control over the situation (D), and also has a pronounced communicative potential, charm and a penchant for leadership (I). At the same time, the author also has features of stability (S), expressed in a sense of responsibility and discipline, as well as in the desire to maintain stability and safety in the environment. Submissiveness traits (C) in this case are not so pronounced, but still can be present to a certain extent, expressed, for example, in the desire to follow certain rules and procedures, as well as in the desire for accuracy and detail in work.	This person is probably quite smart and skillful. He is clearly capable of communicating effectively and getting things done. He is also likely good at networking and building relationships. However, it's also worth noting that some people may find this person too direct or pushy. He can also be perceived as too competitive or ambitious.	The person who wrote these texts probably has the following type of traits: 1. Influence - he likes to be influential and have power. He likes to be able to influence others and strives for status and recognition. 2. Eagerness and purposefulness - prefers to work at a faster pace and set goals for himself and his team members. 3. Decision maker - tends to make decisions quickly and decisively. He may not always consider everyone's contribution, but he is willing to take risks and pave the way forward. 4. Openness in communication - he values open communication within the team and values honesty above all else. He is comfortable sharing information about himself and wants others to do the same.

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Discussion and Conclusions

Thus, both programs and chatbots were able to determine the chosen leader's personality type using the DISC method, based on different sources. At the same time, such a personality type as D (Captain or Dominant) was most often spoken of, only Humantic AI showed a different personality type. Despite the fact that in general the programs showed similar personality types, the severity of personality traits in the programs varies. Stronger unity was obtained in determining the severity of dominant traits - all programs, except for Humantic AI, showed a high degree of severity. Since the type of personality coincides with different degrees of expression of personality traits, it can be assumed that the degree of expression of traits was not always assessed objectively. At the same time, the general description of a person is quite similar in all programs - he is a strong-willed, purposeful, confident person.

The severity of personality traits was more accurately represented in the Crystal program - severity is presented as a percentage, while other programs and chatbots do not have an accurate idea of the rating scale and the corresponding criteria.

In Humantic AI and Crystal, the degree of estimation accuracy was presented by the developers and based on actual data. Information is not disclosed about how artificial intelligence chatbots determined the reliability of their assessments. In addition, the accuracy of the Humantic AI score was based on tests in English, but we also used Chinese text to determine the chosen person's personality type.

During testing of chatbots, the following features of each of the programs were noted: ChatGPT and Open Assistant are able to understand Russian text and respond to it, and the first model answers better in Russian and provides more accurate descriptions of the person. There were typos and logical errors in Open Assistant responses. Bard chatbot understands and is able to respond only in English, but it is able to provide the most detailed descriptions of a person, and also has access to the Internet and can complete its answers using it.

Conclusion

The DISC methodology undoubtedly extends the power of external psychometric analysis based on text analysis and complements previously used methods such as the Big-5.

In general, we can say that the studied programs are able to determine a person's personality type based on his/her texts and social networks, however, in our opinion, today such an assessment is not as reliable as with direct psychometric testing of a person and observation of his/her behavior in real life.

Nevertheless, this method of studying a person is quite useful from a marketing point of view and allows to prepare a product and business offer based on the psychological characteristics of a potential client.

For practical and business purposes, we recommend using different psychometric techniques in combination. This provides a comprehensive assessment of personality and behavioral patterns. An important part of a holistic assessment is also a meaningful content analysis of the text.

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