The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2023

Volume 31, Pages 127-134

ICRESS 2023: International Conference on Research in Education and Social Sciences

Identifying Human Temperament and Character Type for E-Learning Needs Using a Fuzzy Logic Approach

Teimuraz Manjapharashvili
Ivane Javakhishvili Tbilisi State University

Nino Manjaparashvili
The University of Shiffield International Faculty

Abstract: Today, online training and counseling is becoming increasingly popular. This has been achieved through the use of various successful information and communication technologies and electronic tools - Electronic (ICTE). Therefore, significant changes are needed in the training process. People have different perceptions of information and different types of temperament. That is why the training process should be tailored to the needs of each. The training system should take into account that people have different styles of perceiving information according to the temperament and character type of the student-aplicant. This would reduce online training and increase its quality.Traditional psychometric tests are usually very long and difficult, based on a person's opinion of themselves and thus, they give different results depending on the person's mood. Also, depending on the mood and need, the person may be manipulated by possible answers. This is because the answers to such test questions are largely based on ongoing processes in consciousness. So from traditional tests there are other types of tests separately from questionnaires: drawing, colors, geometric figures, pictures, card games, numbers, scenarios, manuscript analysis, drawing and other tests. A special advantage of these types of tests is that they rely more on ongoing processes in the subconscious and are therefore more free to manipulate, while also requiring significantly less time and less dependent on mood.Autors task was to combine several other types of tests and create a free test-short program with the ability to present and process subjective information using modern fuzzy technology, which would allow us to determine the applicant's temperament and character type for e-learning and other needs.

Keywords: E-learning, Human temperament and charaqter type, Tests, Fuzzy logic, Individualization of e-learning.

Introduction

Let's take a look at one of the most modern approaches to determining the applicant's temperament type, which uses Fuzzy set theory approaches to process subjective information - this is the agent-based simulation model for character and perception guessing (Lauberte & Ginters, 2008; Ginters et al., 2011; Lauberte et al., 2010). Agent-based model TemPerMod can be used as a separate tool and as an integral part of the e-learning system. The study was launched at the Institute of Socio-Technical Systems Engineering in 2008 with a new e-learning technology that reports on the temperament and character type of the student-intern. The agent-based TemPerMod model is designed to determine a person's temperament and character type, as traditional tests are long and the irritant and applicant can manipulate the answers.

Agents-based model TemPerMod aims to identify temperament <T> and character type <P> types. This will be determined by the combination of attributes <A>, where C is a favorite color, F is a favorite form, Act is a favorite activity, and S is a favorite expression. Added to this is another attribute - dimension <D> and the user can select 2D or 3D visualization during simulation.

The term "agent-based simulation" refers to a special type of simulation that has two essential components - agents and the environment, where agent behavior is the result of rules that predetermine the interaction between agents and their environment. The environment has some autonomy, e.g. a certain level of independence from what agents do, but it can also be influenced by their behavior. The type of perception is recognized by the agent-based simulation model, rather than the traditional questionnaire (Cirulis & Ginters, 2010).

Agent-based simulation model TemPerMod consists of three levels; At the first level, the specialist can change the appropriate attributes of each type of temperament. E.g. It is possible to identify some attributes from the pre-compiled list - shape, color and activity (Cirulis & Ginters, 2010). This can be done with the Agents & Games Configuration Module. The second level is the main part of TemPerMod. The model desktop (visualization room) is a square shape (box) and is divided into four frames (spaces). Each frame has an equal number of agents that have the same shape and color. At the beginning and end of the simulation session, applicants should answer a few short questions that appear on the screen using the popup (Cirulis & Ginters, 2010). The third level is designed for specialists who can plan or select simulation games or scenarios using existing agents. These games can be additionally used to determine the results. This can also be done using the Agents & Games Configuration Module.

The good thing about agent-based simulation is that the agent can make decisions independently. It requires more activity from agents than passivity. Most agents are characterized by the following: they are flexible autonomous rings and can interact with other agents and the environment. They can be goal-oriented, able to learn and adapt to their behavior based on experience.

Agent-based modeling is becoming increasingly acceptable in many areas of the social sciences because it offers a natural way to describe and analyze people. It is possible to simulate and manage a larger number of important factors, which is practically difficult to do when using another simulation platform (Macal & North, 2007). But this approach also had serious disadvantages. The main thing is the following: the agent-based model TemPerMod also has several limitations:

- This model has only one purpose: to determine the type of temperament and character type of the applicant's.
- TemPerMod requires a serious computer resource (otherwise there will be a jump-jump in the process of simulation).
- The agent-based TemPerMod model is quite long (125 cycles in total), so it is difficult to pay attention to the simulation, especially in the case of choleric type.

The TemPerMod result was compared with the Jung Typology test results with the Soloman and Felder questionnaire. TemPerMod matches the Jung Typology test, which defines phlegmatic people by 75% and melancholics by 71% (Keirsey, 1998), but the comparison does not match in the sanguine and choleric groups. This is a significant drawback. In addition, this approach does not define secondary temperament, while even before that Dellinger (1996) coined the term "psychometrics" and explained not only how to define your own character, but also how to use geometric psychology for any person's beliefs, values. She believed that there are five characters in us, but we have one dominant character and one secondary character that we use mostly, all the other characters are slightly represented inhus. Literally one of the founders of psychometrics in other terms, but clearly stated that the temperament (character type) of any person is a fuzzy set, the maximum value of membership function which belongs to the dominant character, the less to the secondary character, and the smaller the corresponding attributes. This is also completely natural, because a person is not of such a simple psychology that only one temperament (character type) acts at all times and in all situations. Thus, when we want to determine a person's (applicant's) temperament (character type), we need to be able to determine the appropriate fuzzy set of temperaments.

Problem Setting and Solution

The aim of present work was to create a program system for determination temperament and perception type of an applicant, according to the processing of the datas obtained by debriefing of the applicant. Because of specificity, inaccuracy and uncertainty, modern fuzzy informational technologies, based on fuzzy logic, are used. The temperament (character type) of any person (applicant) is defined as the corresponding fuzzy set defined on the five types of Dellinger’s characters.

The most common classification of temperament is also the oldest. It was introduced by Greek healers Galen and Hippocrates, who defined four main groups of temperaments: sanguine, choleric, phlegmatic, and

melancholic. There are many other classifications available today, but the authors realize that this is the best old-fashioned approach. There are many tests to temperament and character recognized. The most popular traditional and scientifically recognized test is the Jung Typology test, which is based on the typology of Carl Jung and Isabel Myers-Briggs and The Keirsey Temperament sorter (Dellinger, 1996; Keirsey, 1998). The Jung Typology Test consists of 72 questions, all of which have only one possible answer "yes" or "no". This test is a formula that conforms to the typology defined by Carl and Isabel Myers-Briggs and includes the unity of the defined characteristics of each type. Keirsey Temperament sorter is based on Keirseys temperament theory. The test consists of 71 questions, each with two possible answers.

As mentioned above, there are other types of tests apart from traditional tests - questionnaires: drawing, colors, geometric figures, pictures, card game, numbers, scenario, manuscript analysis, drawing and other tests. And yet, most of them are not quite accurate or require long testing. Of the many different approaches available in psychology today, we will use Suzanne Dellinger's approach to construct our system and classify temperaments into five groups: sanguine, phlegmatic, choleric, melancholic, supine. People can be classified according to their temperament or character type <T>. Each group has its own appropriate behavior or activity <Act> that matches the predefined color <C> and the shape of the favorite objects <F>. Also, there are two favorite expressions <S> for each group of temperaments.

$$<S>=(s_i) \text{ and } \quad i = 1, ..., 10$$

Favorite slogans of a choleric person are: "I always say what I think" and "Win as much as you want". Sanguine says, "Here and now!" and "The whole world is a stage and the sun is my light." Phlegmatic's favorite sayings are: "Peace at any cost!" and "Let's be friends". Melancholic: "Artist-poet, in search of kindred spirits ..." and "You have a problem, I - no", the fifth type of temperament - of Supine: "I answer with higher power" and "I will do everything for you, provided you do badly don't treat me like that". We can assume that color, shape, activity, and slogans form the plurality of attributes <A>. The purpose of this paper is to identify the applicant's temperament (character type) <T>:

$$<T> \leftarrow A(F, C, Act, S)$$

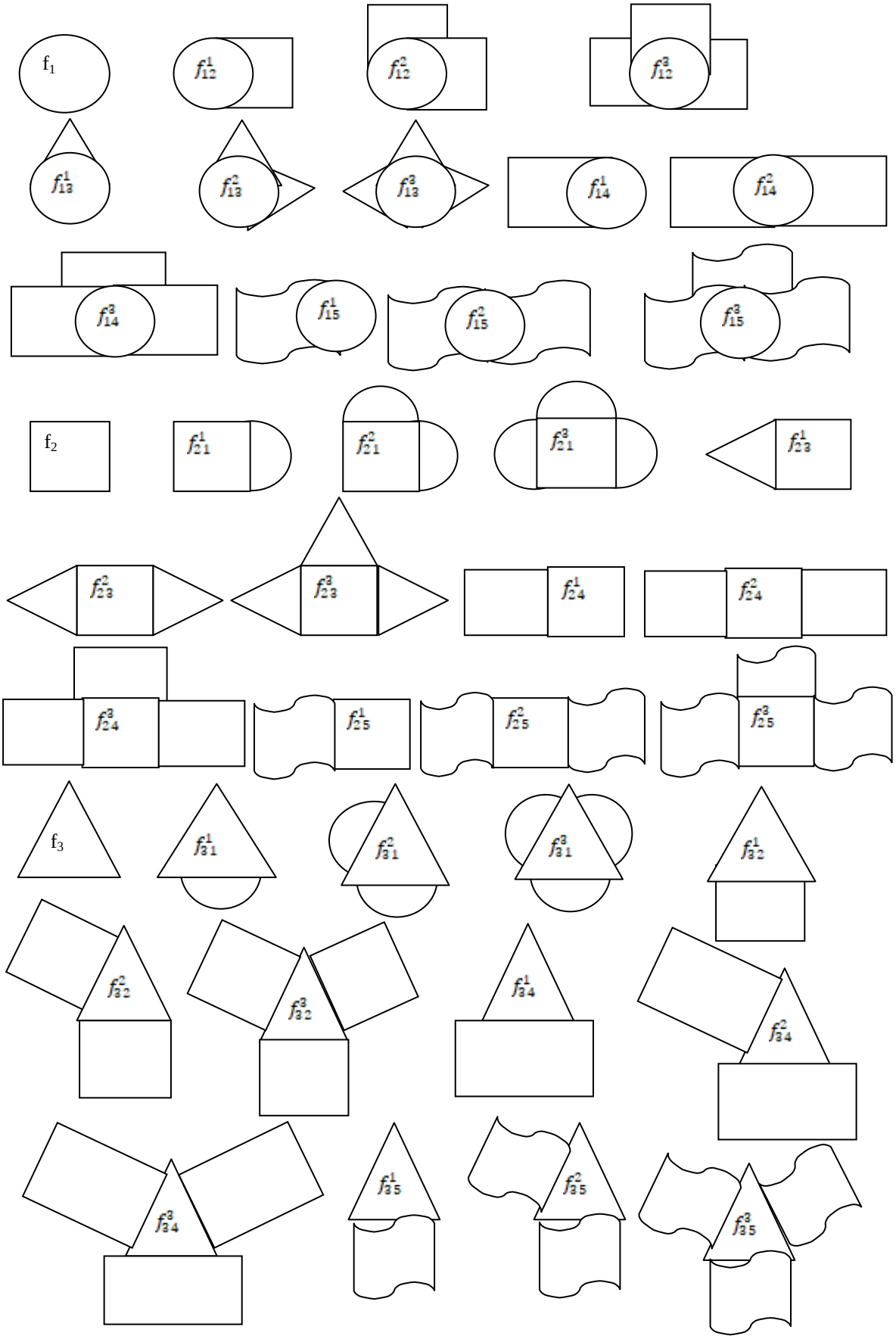
The relevance of each individual attribute color, shape, activity, and slogans to Dellinger's five types of human temperament (character type) is already well known through psychological experiments. The problem is how to combine the results obtained for individual attributes into the fuzzy set on five types of temperaments. To do this, you first need to fuzzificate these individual attributes by defining the values of the membership function in the terms of the corresponding linguistic variables, and then perform the applicant's polls on these linguistic variables. Finally, it is necessary to combine and transform the obtained results in the applicant's temperament (character type) fuzzy set with calculating the values of the membership function (otherwise levels of reliability) of it. As a result, we get a specific fuzzy set with appropriate levels of membership function (levels of reliability) defined on five types of human temperament (character type) that characterize the temperament (character type) of the concrete person (applicant). Existence of reliability levels allows us to determine both primary and secondary temperaments (character type) as well as other temperaments with low levels of reliability. Consider how the four selected attributes - color, shape, activity, and slogans - were fuzzificated.

Fuzzification of Figures

Dellinger (1996) believes that every shape that has a specific outline: circle, square, triangle, rectangle, and curling expresses any temperament (type of character) that exists in us, but we have one dominant and one secondary character that we use mostly. According to Dr. Susan Delinger, 83% of the <F> forms you choose are the ones that reflect your main f_k and secondary f_{kl}^p character Dellinger (1996).

$$<F>= \{f_k , f_{kl}^p\} \text{ and } k, l=1, \ldots, 5; \; p=1, 2, 3$$

Fuzzification of Color These forms are: circle {f1}, square {f2}, triangle {f3}, rectangle {f4}, curling {F5}. Obviously, we think this attribute is fuzzy, so instead of five figures, we will additionally present other combined figures to the applicant, which expands the choice of personality and corresponds to the simultaneous existence of the main and secondary temperament (character type) of a particular applicant. The figures part in the whole algorithm are as follows: first we present the main figures to the applicant - circle {f1}, square {f2}, triangle {f3}, rectangle {f4} curling {f5] to choose the one they like best.


f1
f2
f3

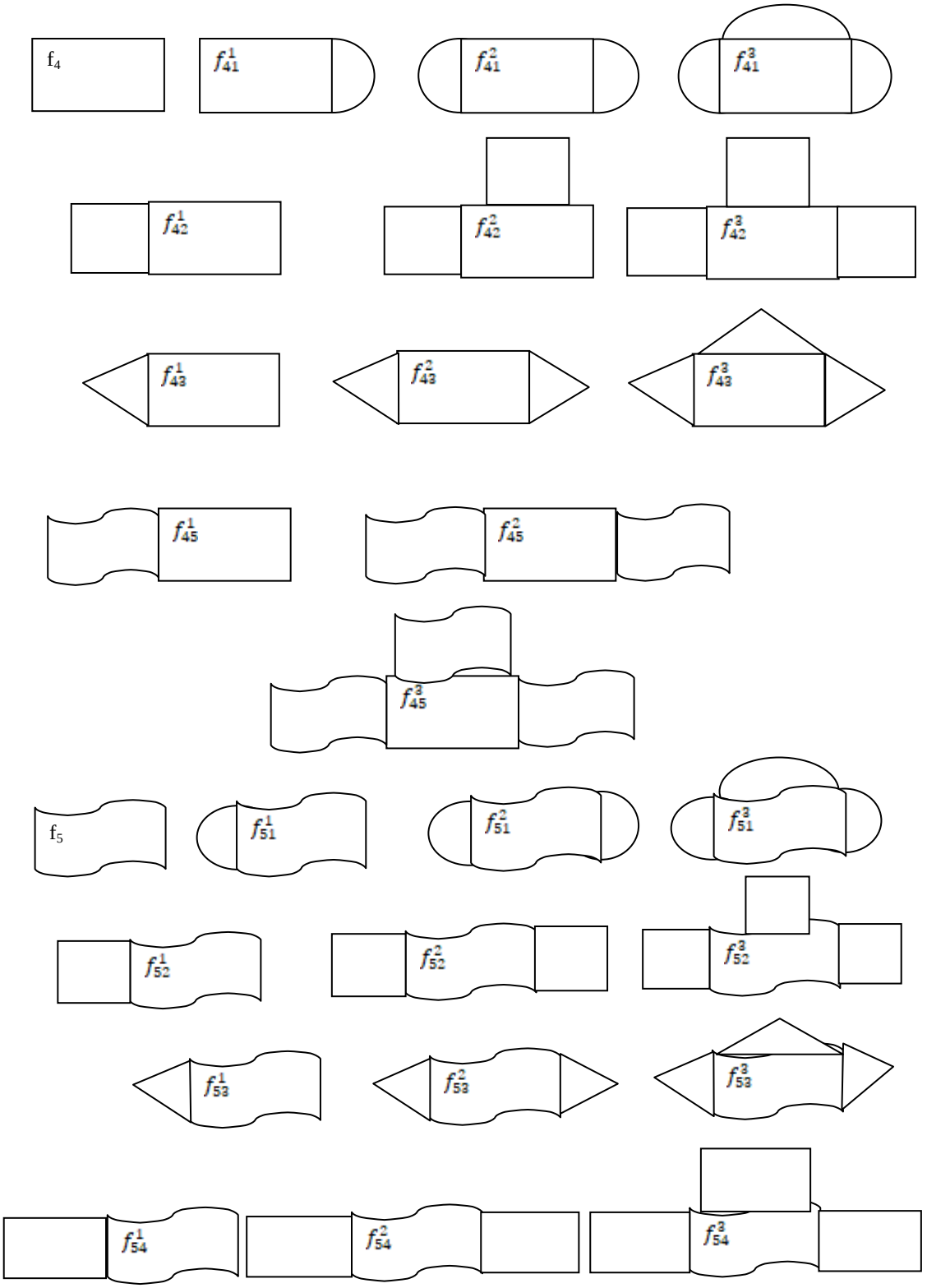


Figure 1. The type of main temperament (character type) and the type of secondary temperament (character type)

This will determine the main temperament (character type). Then we present the corresponding additional figures of the selected main figure to determine the secondary temperament or character. For example: if in the first step he chose a triangle {f3}, in the second step we present him with figures:

$f_{31}^1, f_{31}^2, f_{31}^3, f_{32}^1, f_{32}^2, f_{32}^3, f_{34}^1, f_{34}^2, f_{34}^3, f_{35}^1, f_{35}^2, f_{35}^3$, That is another 12 figures in each case, (See the picture below).

Let's see how we can calculate the values of the membership function. The values of the membership function of the main figure is always equal to 1, and in the case of the presence of additional figures they defined as follows: it is equal to as many quarters as the number of figures it has added of the other main figure. Otherwise, it is equal to a quarter of the top index function in the figure above - f_{31}^1 figure is equal to 0.25, f_{31}^2 is equal to 0.5, f_{31}^3 figure is 0.75, f_{32}^1 - 0.25, f_{32}^2 – 0.5, f_{32}^3 - 0.75 and etc. Similarly in the case of any other major figure. This choice determines the type of main temperament (character type) and the type of secondary temperament (character type) by the degree of its membership function - the levels of reliability. See Figure 1.

For fazzification of color we will rely an additive system introduced by James Maxwell - RGB (red, green, blue) in 1860 (CMYK, n.d.). This system now dominates the color reproduction (color production) systems of electron-beam tubes of monitors and televisions. This parameter is fuzzificated according to the frequency characteristic of the colors. Obviously, this attribute is fuzzy with us, so we present to the applicant 8 colors of the spectrum: red, orange, yellow, green, blue, blue, violet, purple - which expand the choice of personality and correspond to the simultaneous existence of main and secondary temperament (character type) in a particular applicant. The colors part of mine algorithm is as follows: The applicant will be presented with 5 of the 8 colors listed above - yellow, blue, purple, red, green, and will be given the option to choose one primary color that he or she likes. It will then be presented with the remaining 3 colors - orange, blue, violet - and will be given the option to choose one additional color. The first selection corresponds to the existence of the main temperament (character type) and the second corresponds to the existence of the secondary temperament (character type) of the given applicant. This choice determines the type of main temperament (character type) and the type of secondary temperament (character type) by the degree of its membership function - the levels of reliability. In addition to the three primary colors (red, green, blue), all the predatory colors are obtained by mixing different proportions of the primary and additional colors, as in CMYK color model. Therefore, the degree of the membership function of assigning the three primary colors is considered to be equal to 1, and the values of the membership functions of assigning the rest of the colors are calculated according to the proportions of the mix.

Fuzzification of Activity

We have a scale of personality-related activities:

$$<Act>= \{act_n\} \text{ and } n=1, \ldots, 5$$

As already mentioned, activities can range from static to very active or even chaotic. Obviously, with us this attribute is fuzzy. The terms of this linguistic variable are as follows: Act5 - very active (chaotic), Act4 - active, Act3 - neutral, Act2 - passive and Act1 - inert. The applicant will be presented with the pictures of the famous "hat test" in psychology and will be offered to choose the line of drawings that he likes. This determines the main activity with its membership function. He will then be presented with well-known "stone test" drawings in psychology, and will be asked to choose the line of drawings he likes. This determines the second activity with its membership function. The first selection corresponds to the existence of the main temperament (character type) and the second selection corresponds to the existence of the secondary temperament (character type) of the given applicant. This choice determines the main type of temperament (character type) and the type of secondary temperament (character type) with the degree of its membership function - the levels of reliability. Approximately the same is the case with the fourth attribute-favorite slogans. We are unable to give complete the process of fuzzification of this attribute due to lack of space.

Fuzzification of the Output Variable

Dellinger's work shows, the output variable is the sum of one major temperament (character type) and one secondary temperament (character type). The correspondence of the terms of the variable output in the algorithm with the types of temperament is as follows:

T1-sanguine
T2-phlegmatic

T3-choleric
T4-melancholic
T5-supine.

Since the variables in our case are fuzzy variables, the output variable will be a fuzzy set defined in the 5-temperament set aboveand μ_1 is the level of reliability of the primary temperament (character type), while R_1 is the value of the primary temperament (character type), and μ_2 is the level of reliability of the secondary temperament (character type), therefore R_2 is the value of the secondary temperament (character type), R_i=T1vT2vT3vT4vT5. The task of our algorithm is to determine the types and reliability values of primary and secondary temperament (character type) according to the membership values of the input fuzzy variables from the list of 5 temperaments listed above for a particular applicant. The algorithm will incorporate a pre-built knowledge base that expresses the connection of the individual attribute to the set of Delinger's five-element temperaments (character types). These separate classical (non-fuzzy) correspondences are known from the experiments of psychologists. After conducting the survey results in the knowledge database, we finally get the output fuzzy variables - the applicant's temperament in the following 2 fuzzy sets:

$$\mu_1^1 R_1^1 + \mu_1^2 R_1^2 + \mu_1^3 R_1^3 + \mu_1^4 R_1^4; \quad \mu_2^1 R_2^1 + \mu_2^2 R_2^2 + \mu_2^3 R_2^3 + \mu_2^4 R_2^4$$

Where all μ are numbers from 0 to 1 including 1, and R1 and R2 are one of the 5 temperaments defined from the beginning, R_i=T1vT2vT3vT4vT5. Then with fuzzy logic operations is obtained one primary and one secondary temperament type as follows: in the first set (in the set of primary temperaments) the corresponding Rs of the same temperament can be repeated, so we take the final value of the primary temperament as the R most commonly found. Its membership function will obviously be equal to one. In the second set (in the set of secondary temperaments) some Rs may have different values of the membership function. As a result, we get the fuzzy set defined on temperament types:

$$\mu_1 T_1 V \mu_2 T_2 V \mu_3 T_3 V \mu_4 T_4 V \mu_5 T_5$$

Where V denotes the "or" operation. In general the applicant temperament set is the fuzzy set, but if we want to get only the primary and secondary temperaments, then according to the principle of maximum we leave only two type of temperaments that will have the maximum membership functions. This temperaments will be a type of primary and secondary temperaments with its membership functions (reliability levels). Similarly, we can calculate the levels of reliability of other temperaments if we need it. A test program has been created that determines the primary and secondary temperament of a particular applicant in seconds after asking about ten questions. The created program communicates with the applicant in a dialog mode through dialog boxes. After fixing all four choices of the applicant, the button - "View results" is activated.

After clicking on the "View results" button, the final window of the program displays the type of primary temperament (character type) expressed in terms of its reliability (meaning of membership function), and the type of secondary temperament in the lower row with its level of reliability (meaning of membership function) and short verbal description of temperaments.

Conclusion

Human behavior is a complex, emerging phenomenon. Therefore, its description by mathematical equations is difficult. Psychologists have long concluded that the mechanism of temperamental decision-making has a strong influence on the systemic performance of both a particular person and a group of people. Because traditional tests are long, the irritant and the applicant can manipulate the answers, creating alternative approaches to determining a person’s temperament and perceptual regimen.

This paper combines several such alternative types of tests and uses modern fuzzy information technologies to present and process subjective information. It should be noted that the program algorithm is original. The program was also tested on different people, which showed that unlike the existing TemPerMod approach, the software system is equally successful in recognizing the temperament and character type of applicants with all five types of temperament. It is also free from other drawbacks of the existing TemPerMod approach. This type of software system can be of great use in the individualization of e-learning, which ultimately allows learning time to be reduced and efficiency to be significantly increased. It can have many other uses as well.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Research in Education and Social Sciences (www.icress.net) held in Budapest/Hungary on July 06-09, 2023

References

Cirulis, A., & Ginters, E. (2011). Training scenario operations realization in virtual reality environment. *Proceedings of the 13th WSEAS International Conference on Automatic Control, Modelling & Simulation (ACMOS 11).* Spain, 33-45.

CMYK. (n.d.). Color model about the CMYK color model graphic design. Retrieved from http://graphicdesign.about.com/od/colorbasics/a/cmyk.htm.

Dellinger S. (1996). Communicating beyond our differences: Introducing the Psycho-Geometrics System., *Jade Ink; 2nd edition*

Ginters, E., Sakne, I., Lauberte, I., Aizstrauts, A., Dreija, G., Chinea, R.M.A., Merkuryev, Y., Novitsky, L., & Grundspenkis, J. (2011). Simulation highway – direct access intelligent cloud simulator, *Proceedings of 23th Europen Modelling & Simulation Symposium (EMSS2011)*, 62-72.

Keirsey, D. (1998). *Please understand me II: Temperament, character, intelligence* (1st ed.). Prometheus N e m e s i s

Keirsey. (n.d.). Overview of Keirsey's four temperaments. Retrieved from http://www.keirsey.com/synergyleaders/overvi ew_all.aspx

Lauberte, I., & Ginters, E., (2010). Agent-based simulation use in multi-step training systems based on applicant's character recognition. *Proceedings of 13th East-European Conference on Advances in Databases and Information Systems.* Riga, 16-22.

Macal, C.M., & North, M.J. (2007). Agent-based modeling and simulation: Desktop ABMS. *Proceedings of the 2007 Winter Simulation Conference*, Washinghton, 95-106.

Author Information

Teimuraz Manjapharashvili
Ivane Javakhishvili Tbilisi State University
Tbilisi, Georgia
Contact e-mail: *teimuraz. manjafarashvili@tsu.ge*

Nino Manjaparashvili
The University of Shiffield International Faculty
Tbilisi, Georgia

To cite this article:

Manjapharashvili, T., & Manjaparashvili, N. (2023). Identifying human temperament and character type for e – learning needs using a fuzzy logic approach. *The Eurasia Proceedings of Educational & Social Sciences (EPESS), 31,* 127-134.