IDENTIFICATION AND CLASSIFICATION SYSTEM OF STUDENTS' TALENTS AND INTERESTS IN DISTANCE EDUCATION USING SOFT COMPUTING

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Abstract

Distance education students have diverse ages, jobs, and domicile characteristics. Therefore, distance higher education faces challenges in developing policies according to students' needs and characteristics. Distance higher education needs a system that can analyze talents and interests so that students and campuses get references in making decisions. Universitas Terbuka has more than 400 thousand students and requires extensive data analysis to provide targeted services for all parties. This article aims to create a model for identifying and classifying the talents and interests of distance education students using soft computing. In the experiment phase, we applied the model to new students at the Universitas Terbuka Padang, Indonesia. Finally, the results obtained recommendations for talent and interest management systems based on model accuracy and challenges that need to be anticipated immediately by policymakers.

Keywords: classification, talent and interest, distance education, soft computing

1 INTRODUCTION

Identification and development of student talents in distance education is currently not optimal. The process of implementing selection and coaching in channeling student potential is a challenge in itself for distance education universities.

The Open University, as a pioneer of distance education in Indonesia, has students spread throughout the country and abroad. Currently, in the odd 2023/2024 semester, the number of UT students has reached more than 500,000 people. This is an extraordinary achievement, so optimizing services, especially for students, is necessary. UT always holds student activities at local, national, and international levels. However, the obstacle regional UTs face, especially UT Padang, is detecting student activities under students' dominant potential and talents per region.

Meanwhile, as we know, each individual has diverse intelligence (Gardner & Hatch, 1989), known as Multiple Intelligences (MI). Knowledge about a person's dominant intelligence has been widely applied in various fields, including psychology, neuroscience, and genetics (Davis,

Christodoulou, Seider & Gardner, 2011), organizations or companies (Pynes, 2008), and the implementation of MI in higher education (Kezar, 2001; Visser, Ashton & Vernon, 2006). Universitas Terbuka is expected to have a soft computing-based application to detect and classify student intelligence based on region and faculty.

N-soft set is part of soft computing (Fatimah, Rosadi, Hakim, & Alcantud, 2018). This is because the N-soft set can facilitate various types of assessment data. N-soft set also allows researchers in the same field and across fields to develop new ideas for existing definitions and implement them in various studies. The application of N-soft sets in overcoming various decision-making problems is shown in the following research: N-soft sets for incomplete data (Fatimah, 2018), big data (Fatimah, 2021a, 2021b), parameter reduction (Akram, Ali, Alcantud, & Fatimah, 2020), tourism (Fatimah, & Andriyansah, 2020), and voting (Fatimah, Rosadi, Hakim, Alcantud, 2017).

Therefore, this paper explains the development of a soft computing-based application, namely N-soft sets, which can be used for big data in identifying and classifying student intelligence.

2 METHODOLOGY

This research uses the development method. Development of applications based on soft computing algorithms, namely N-soft Sets in the TIA (Talent and Interest Allocation) application. The research population was new students from Universtas Terbuka Padang in the odd semester of 2023/2024. The sampling technique used is probability sampling. The research sample comprised new UT Padang students who took the interest and talent allocation test using the TIA application. Sample data was obtained from 227 students. The list of questionnaire questions is made based on Table 1.

Table 1. Variable Operational Definitions

Variable (Intelligence Type)	Item Code	Question
Linguistics ($\boldsymbol{a}$)	$\boldsymbol{a_1}$	You like to read various writings: newspapers, magazines, car brands, stickers on city transportation, and even product labels.
	$\boldsymbol{a_2}$	Two of the games that you like are Scrabble and TTS.
	$\boldsymbol{a_3}$	You are pretty confident and convincing when arguing with others.
	$\boldsymbol{a_4}$	You can provide clear and straightforward directions or explanations.
Mathematical Logic ($\boldsymbol{b}$)	$\boldsymbol{b_1}$	Your daily activities are neatly arranged and organized.
	$\boldsymbol{b_2}$	Logic games like chess and computer games require your preferred strategy.
	$\boldsymbol{b_3}$	When faced with a problem, you usually compile your steps.
	$\boldsymbol{b_4}$	You like to see or look for patterns of relationships between objects or between numbers.

Variable (Intelligence Type)	Item Code	Question
Musical ($\boldsymbol{c}$)	$\boldsymbol{c_1}$	While doing something, you like to hum or whistle.
	$\boldsymbol{c_2}$	Memorizing songs, especially the tunes, is very easy for you.
	$\boldsymbol{c_3}$	There are one or several musical instruments that you can play.
	$\boldsymbol{c_4}$	If music is playing, you can sing in the right notes.
Kinesthetic ($\boldsymbol{d}$)	$\boldsymbol{d_1}$	It is not enough just to see it to learn new things. You prefer to be able to do it yourself.
	$\boldsymbol{d_2}$	You like adventures that impress you are spectacular, and are physically demanding.
	$\boldsymbol{d_3}$	When exercising is an activity that you look forward to at school.
	$\boldsymbol{d_4}$	Solving a problem while moving: walking, running, or exercising is the right way and makes you more comfortable.
Interpersonal ($\boldsymbol{e}$)	$\boldsymbol{e_1}$	If there is a problem, you prefer to discuss it with others rather than think about it yourself.
	$\boldsymbol{e_2}$	You like to 'get together' with friends during your free time.
	$\boldsymbol{e_3}$	You like to direct other people to do something, and you like to be a leader.
	$\boldsymbol{e_4}$	You quite often help friends solve their problems.
Intrapersonal ($\boldsymbol{f}$)	$\boldsymbol{f_1}$	I am participating in self-development seminars that interest you.
	$\boldsymbol{f_2}$	When holiday time comes, you imagine a comfortable place to be alone, to reflect, not too crowded and not in the city center.
	$\boldsymbol{f_3}$	You set your life goals and know where you are going
	$\boldsymbol{f_4}$	You prefer activities you can do alone rather than those involving many people.

This section explains the definition of N-soft sets and the algorithms to be used.

The universal set of objects is expressed by the notation U, E symbolizes the universal set of parameters or attributes with $A \subseteq E$ dan an ordered set of ranks using the notation $R = \{0, 1, \dots, N-1\}$ where $N = \{2,3, \dots\}$.

Definition 1. (Fatimah et al.al., 2018)**.** Let U denote the universe of objects and Q h the set of attributes, $A \subseteq Q$. Let $G = \{0,1, \dots, N-1\}$ be a rank-ordered set with $N \in \{2,3, \dots\}$. The *N-soft set* over U, denoted by, is the result of the mapping $F: A \to 2^{U \times G}$ for each $q \in A$ exist singly contained$(u, g_q) \in U \times G$ such that $(u, g_q) \in F(q), u \in U, g_q \in G$.

Let $U = \{u_i \mid i = 1,2, \dots, m\}$ and $A = \{q_j \mid j = 1,2, \dots, n\}$ is a finite set, so the N-soft set can be represented in tabular form, as shown in Table 2.

Table 2. N-Soft Set

(F, A, N)	q_1	q_2	$\cdots$	q_n
u_1	r_{11}	r_{12}	$\cdots$	r_{1n}
u_2	r_{21}	r_{22}	$\cdots$	r_{2n}
$\cdots$	$\cdots$	$\cdots$	$\cdots$	$\cdots$
u_m	r_{m1}	r_{m2}	$\cdots$	r_{mn}

Source: Fatimah et al. (2018)

3 FINDINGS AND DISCUSSION

This research uses actual data from Universitas Terbuka Padang Students. Let $U = \{u_i\}$ represent new students at Universitas Terbuka Padang in Odd Semester 2023/2024. Research data was taken in two locations, namely District 50 Cities and Bukittinggi, with different respondents. The total sample collected was 227 students with index $i = 1, \dots, 227$. Let $A = \{a, b, c, d, e, f\}$ States the type of intelligence, namely, a: linguistic, b: logical-mathematical, c: kinesthetic, d:musical, e:interpersonal, dan f:intrapersonal. The parameters for measuring each type of intelligence refer to Table 1. Students provide an assessment in the form of a rating $R = \{0,1,2,3,4\}$ Namely "never" (0), "very rarely" (1), "sometimes" sometimes" (2), "often" (3), and "always" (4). So, it is known that *N=5*. The threshold (T) used in this example is the value $r \geq 3$. The Decision (k_A) is obtained if 75% of the parameters in the intelligence group meet the threshold, then the student (u_i) is categorized as having the type of intelligence according to that group.

Tables 3 to Table 5 present data from three students' entries as five soft sets denoted by (F, A, 5). when answering questions according to Table 1.

Table 3. $(F, a, 5)$ & $(F, b, 5)$

U	a				b			
	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4
u_1	2	3	2	0	2	4	3	2
u_2	3	3	4	3	3	2	4	4
u_3	3	2	3	1	1	4	4	2

Table 4. $(F, c, 5)$ & $(F, d, 5)$

U	c				d			
	c_1	c_2	c_3	c_4	d_1	d_2	d_3	d_4
u_1	1	2	2	1	4	3	3	2
u_2	2	3	4	1	1	1	2	3
u_3	3	0	4	2	3	3	2	2

Table 5. $(F, e, 5)$ & $(F, f, 5)$

U	e				f			
	e_1	e_2	e_3	e_4	f_1	f_2	f_3	f_4
u_1	3	2	1	1	3	1	3	3
u_2	3	3	3	2	3	3	2	2
u_3	3	2	3	2	3	3	4	3

Because the threshold $T = 3$, then for $r \geq 3$, the conversion becomes one; otherwise, it is given a score of 0. Tables 6 to 8 present the conversion results of 5-soft sets, $(F, A, 5)'$.

Table 6. $(F, a, 5)'$ & $(F, b, 5)'$

U	a				k_a	b				k_b
	a_1	a_2	a_3	a_4		b_1	b_2	b_3	b_4	
u_1	0	1	0	0	25%	0	1	1	0	50%
u_2	1	1	1	1	100%	1	0	1	1	75%
u_3	1	0	1	0	50%	0	1	1	0	50%

Table 7. $(F, c, 5)'$ & $(F, d, 5)'$

U	c				k_c	d				k_d
	c_1	c_2	c_3	c_4		d_1	d_2	d_3	d_4	
u_1	0	0	0	0	0%	1	1	1	0	75%
u_2	0	1	1	0	50%	0	0	0	1	25%
u_3	1	1	0	0	50%	1	0	1	0	50%

Table 8. $(F, e, 5)'$ & $(F, f, 5)'$

U	e				k_e	f				k_f
	e_1	e_2	e_3	e_4		f_1	f_2	f_3	f_4	
u_1	1	0	0	0	25%	1	0	1	1	75%
u_2	1	1	1	0	75%	1	1	0	0	50%
u_3	1	0	1	0	50%	1	1	1	1	100%

So, the Decision is obtained based on the criteria$k_A \geq 75\%$. Students who meet the criteria for a particular type of intelligence are marked √, and those who do not are given the symbol × (Table 9).

Table 9. The Decisionk_A

U	k_a	k_b	k_c	k_d	k_e	k_f
u_1	×	×	×	√	×	√
u_2	√	√	×	×	√	×
u_3	×	×	×	×	×	√

The calculation stages above were carried out for all samples, namely 227 students. The TIA application can calculate and display results automatically. Meanwhile, decision-makers can retrieve data according to the period for filling out the questionnaire. So, the TIA application is straightforward and valuable.

An example of a recapitulation of the intelligence test results for new UT Padang students in the 50 cities' regency and surrounding areas can be seen in Figure 1. A recapitulation of student dominants per type of intelligence can be seen in Figure 2.

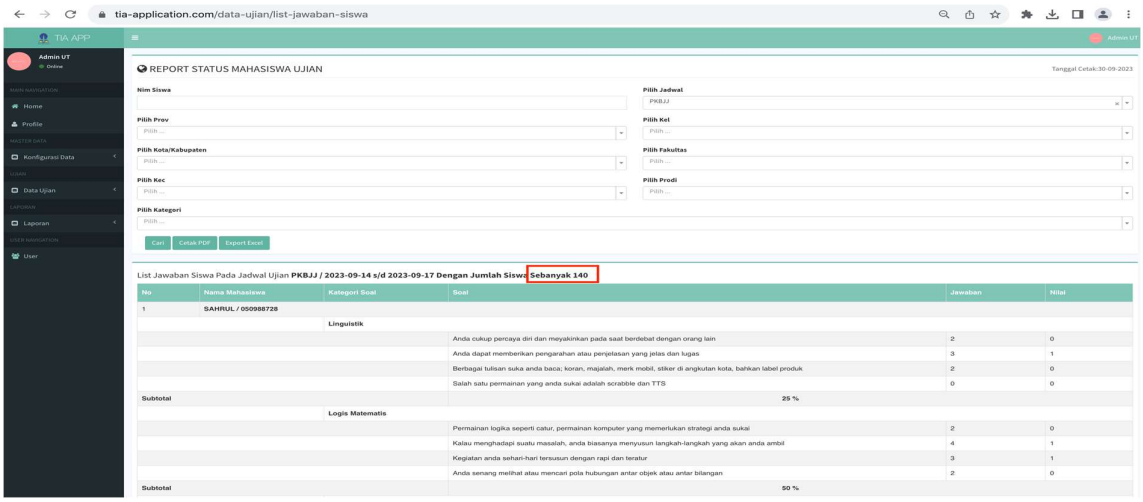

Figure 1. Display of TIA Test Results for Students in 50 Districts and Surrounding Areas

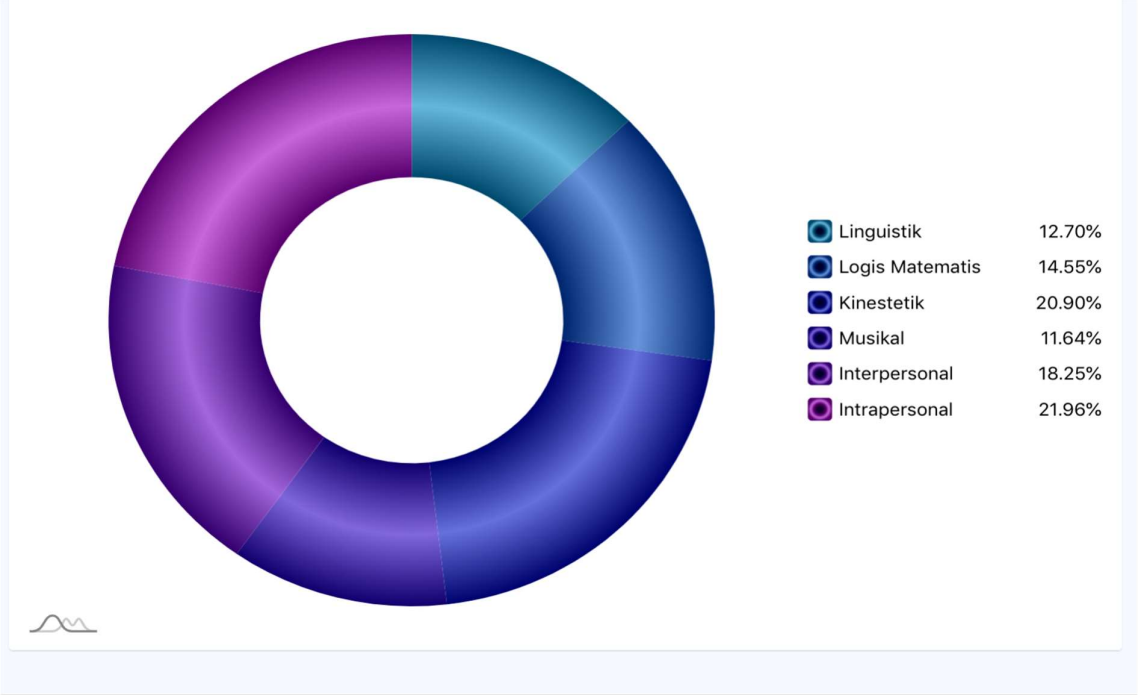

Figure 2. District Responder Intelligence Group for 50 Surrounding Cities

An example of a recapitulation of the intelligence test results for new UT Padang students in the Bukittinggi City area and its surroundings can be seen in Figure 3. A recapitulation of dominant students per type of intelligence can be seen in Figure 4.

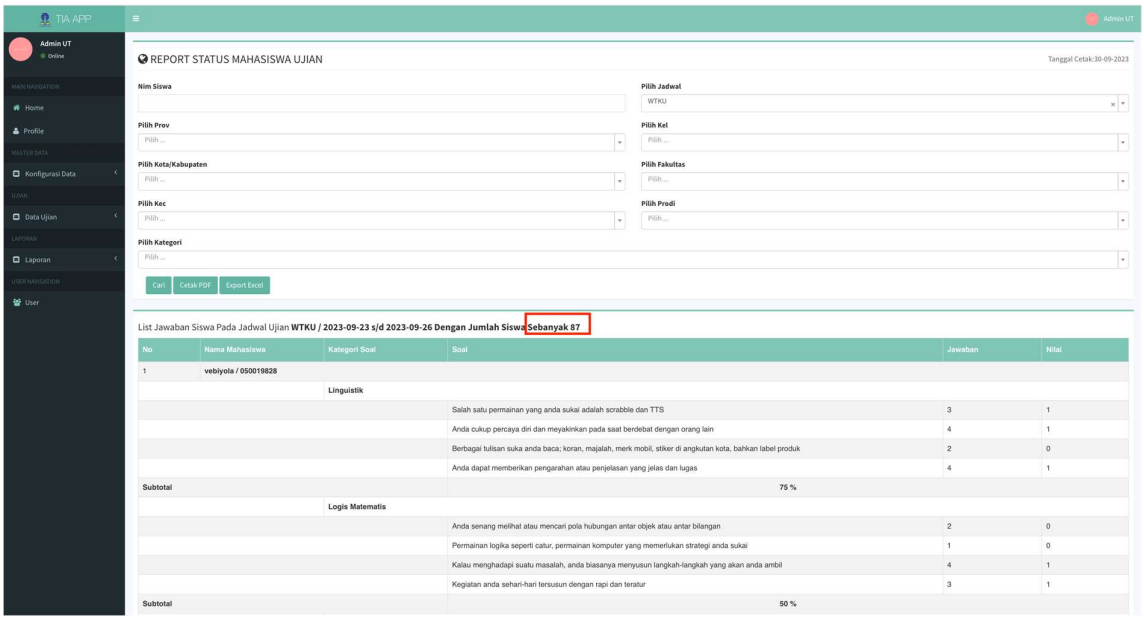

Figure 3. Display of TIA Test Results for Bukittinggi City Students and Surrounding Areas

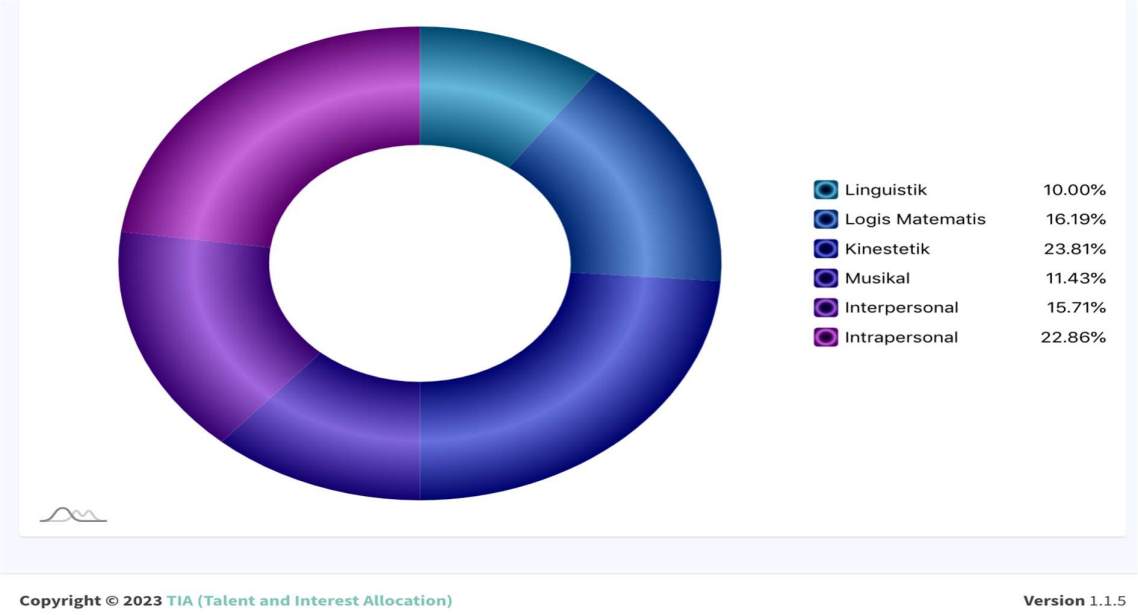

Figure 4. Bukittinggi City and Surrounding Area Respondent Intelligence Group

Students who have finished filling out the questionnaire on the TIA application can find out their respective intelligence types because the scores immediately appear (Fig. 5). These results are stored in the student's TIA application so they can be checked at any time.

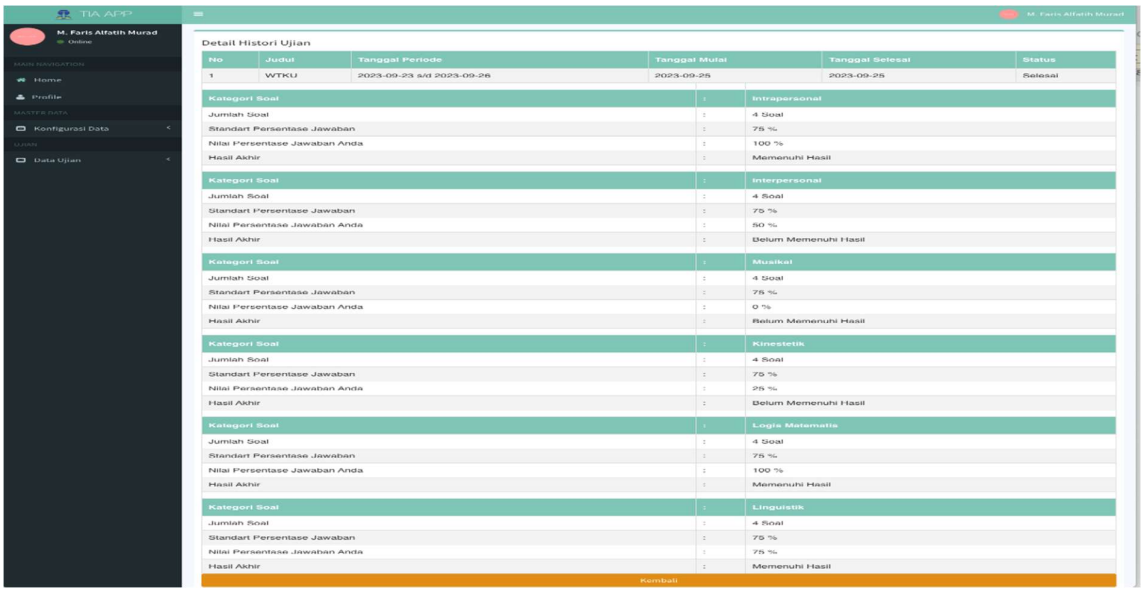

Figure 5. Display of TIA Results from Student Accounts

4 CONCLUSION

Universitas Terbuka, with a student population of half a million, must prepare support services to identify students' talents and interests. Identification and classification of student intelligence is an excellent opportunity for UT because it knows more about the characteristics of students per region. As a result, the activities carried out per region are right on target for students, effective according to achievement targets, and efficient in using funds. The TIA (Talent and Interest Allocation) application based on soft computing, especially N-Soft Sets, can be applied throughout UT Padang and even UT in other regions. The results obtained are accurate, and agents can immediately see their respective types of intelligence. Using the TIA application can also be an online exam simulation for new students.

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