

Expert System of Personality Analysis Based on Graphology Handwriting and Signature

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Abstract: Personality is the integration of all individual characteristics into a unique entity that is decisive, and modified by effort- his effort in adjusting to a constantly changing environment. Graphology is the science or art of reading one's handwriting. Similar to DNA or fingerprints of a person, which has its own uniqueness to characterize the uniqueness of a human being. Graphology has two techniques, namely German and French. German method by looking at a person's entire writing. Analysis in the German method is carried out using the image of someone's handwriting. In the handwritten image, it is pre-processed first, then segmentation which includes line, word, and character / letter segmentation. Whereas the French Method tends to analyze by letter and then combined. The French method is done in the form of a line of reasoning that uses a line of reasoning or question and answer. In the analysis of the French method using the Certainty Factor method to get the percentage of expert beliefs from the personality results of the system. The self personality test expert system is a web-based system that presents the results of a person's personality test and also provides information about the types of personality that exist. System testing was carried out using 20 samples. From the results of the system output and expert trials obtained accuracy in the German method by 80% and the French method by 90%.

Keywords : Expert System, Personality, Graphology, Certainty Factor, Image Processing

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I. Introduction

Personality is an integration of all the characteristics of individuals into a unit unique is decisive, and as modified by its efforts to adapt to a changing environment constantly [1]. Efforts to understand behavior or expose the human personality are carried out starting with the simplest way, which is classified as a non-scientific approach, up to modern ways or scientific approaches.

Graphology or handwriting analysis is a scientific method of identifying, evaluating and understanding characters through patterns [2]. Similar to DNA or fingerprints of a person, which has its own uniqueness to characterize the uniqueness of a human being. Graphology has two techniques, namely German and French. German method by looking at a person's entire writing. Analysis in the German method is carried out using the image of someone's handwriting. In the handwritten image, it is pre-processed first, then segmentation which includes line, word, and character / letter segmentation. Whereas the French technique tends to analyze by letter and then combined. The French method is done in the form of a line of reasoning that uses a line of reasoning or question and answer. In the analysis of the French method using the Certainty Factor method to get the percentage of expert beliefs from the personality results of the system.

The Handwriting and Signature Graphology Expert System will make it easier for psychologists to find out a person's personality with a fast time and precise results. The general public can also know the character of his personality without having to consult directly with a psychologist.

II. Literature Review

2.1 Personality

Personality is a typical pattern of someone in thinking, feeling and behaving which is relatively stable and predictable. Personality is also the integration of all individual characteristics into a unique unity that is decisive, and which is modified by his efforts in adjusting to a constantly changing environment [1]. Based on this understanding, it can be concluded that personality encompasses all patterns of behavior and traits that are unique and predictable to a person, which is used to react and adjust to stimuli, so that his behavior patterns constitute a functional unitary characteristic of the individual. Personality is dynamic, meaning that it always changes, but in those changes there are patterns that are permanent.

2.2 Graphology

Graphology is the science or art of reading one's handwriting patterns [2]. Pattern recognition or known as pattern recognition is one branch of science [3]. Similar to DNA or fingerprints of a person, which has its own uniqueness to characterize the uniqueness of a human being. Humans were created very unique indeed and nothing is the same. Graphology can be learned simply and not difficult to be able to learn it [7]. Several studies on graphology have been carried out, such as the most dominant features of handwriting used in graphological analysis, including page margins, line spacing, slashes, word slope, angle sharpness, font size, text density, writing speed and writing regularity [4].

Table no 1: Graphology Traits.

Trait	Character Handwriting	Personality
Margin Handwriting	Margin Balance Left Margin Width Margin Right Wide Margin Up Wide Margin Bottom Width No Margin	Emotions Stable Closed Not Confident Shy Idealists Very Confident
Baseline Handwriting	Baseline Straight Baseline Ascending Baseline Descending	Self-Control Good Optimistic Pessimism
Size Handwriting	Size Medium Writing Size Large Writing Size Small Writing Size	Flexible Open Shy
Space	Spacing Between Words Inter Spacing Ideal Spacing Between Words Wide Spacing Between Narrow Words	Stable Emotion Less Confidence Confidence Closed

2.3 Expert System

Expert system is a computer program designed to take decisions such as decisions taken by one or several experts in a particular field [5]. Expert system is a computer software system that uses knowledge, facts, and thinking techniques in making decisions to solve problems that usually can only be solved by experts in the field concerned.

In its preparation, the expert system combines inference rules with certain knowledge bases provided by one or more experts in a particular field. The combination of these two things is stored in a computer, which is then used in the decision making process for solving certain problems.

2.4 Certainty Factor Method

The certainty factor was introduced by Shortliffe Buchanan in making MYCIN [5]. Certainty Factor (CF) is the clinical parameter values given by MYCIN to indicate their magnitude trust. An expert often analyzes existing information with phrases such as "maybe", "most likely", "almost certain". To accommodate this, Certainty Factor (CF) is used to describe the level of expert confidence in the problem being faced. Certainty theory underlies the use of Certainty Factors to express trust based on events [6].

In making MYCIN, the degree of trust and distrust is determined by the Certainty Factor which is the difference between trust and distrust:

$$CF[h,e]=MB[h,e]-MD[h,e]$$

where:

CF[h,e] : certainty factor

MB[h,e] : Measure of trust in hypothesis h, if given evidence e (between 0 and 1)

MD[h,e] : Measure of mistrust of hypothesis h, if given evidence e (between 0 and 1)

2.5 Preprocessing

Handwriting recognition in terms of time of introduction is done off-line and on-line. Handwriting used as an image is then recognized by the computer through the stages of the process that must be done is Gray Scaling, Thresholding, Line Segmentation, Word Segmentation, Character Segmentation / Letters. The purpose of Preprocessing is to make image data suitable for feature extraction by filtering unwanted attributes, improving quality, and transforming. The method used in the handwriting Preprocessing is made into a picture and then recognized by the computer through the stages of the process that must be done.

III. System Design

This system uses two methods, namely the French method and the German method. The French method for personality analysis is based on the letter character of the writing. The grading of each question uses the certainty value (mb) and the uncertainty value (md). German method for personality analysis through handwritten imagery and signatures.

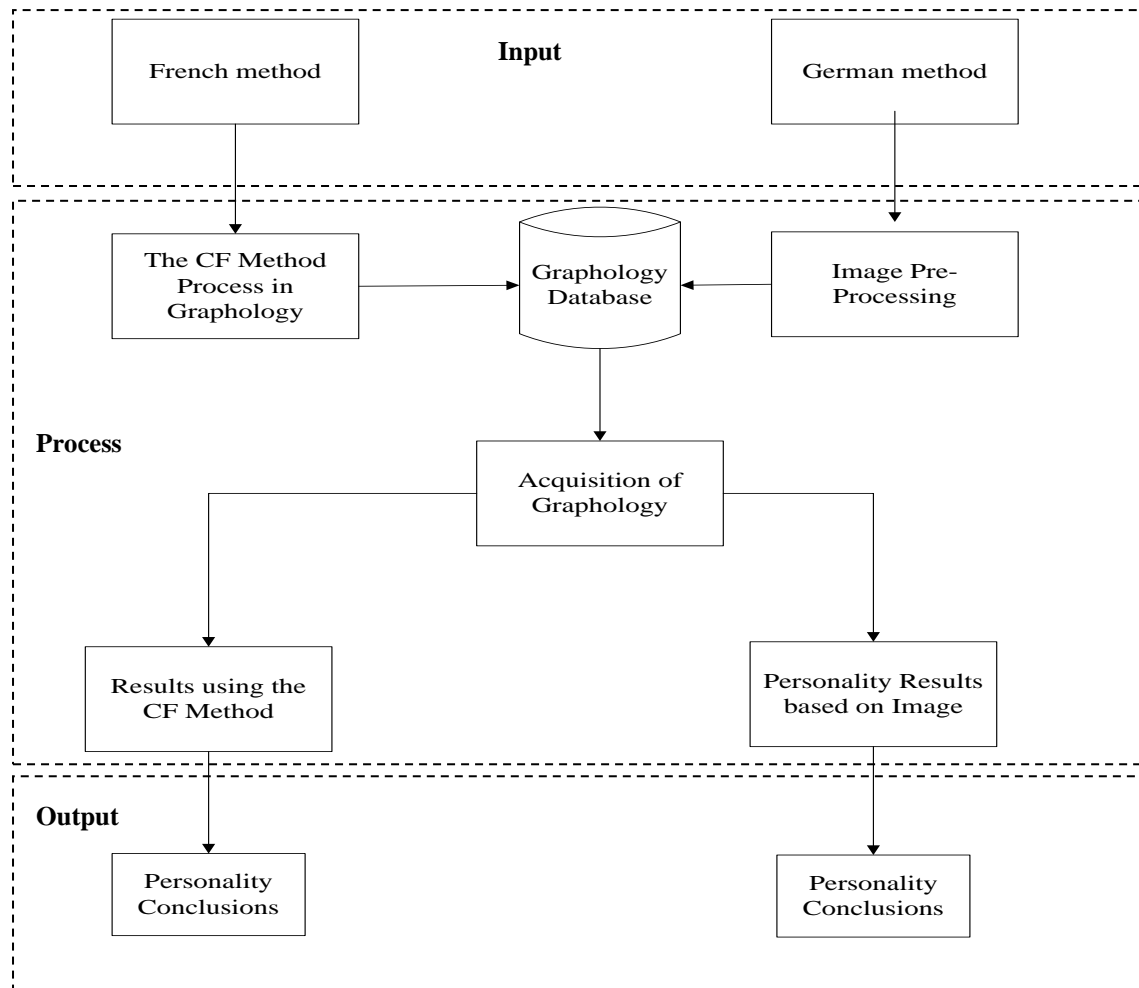


Figure 1 : The Block Personality Expert System Diagram

Figure 1 is a block diagram diagram of an expert system. The output of the Personality Analysis Based on Handwriting and Signature Graphology application is a personality conclusion from the results of the handwriting and handwriting Graphology method along with the percentage value generated by the Certainty Factor method.

The first step in the design and development of the application of Personality Analysis Based on Handwriting and Signature Graphology is to identify the problem being examined. The existing problems will be identified first, the creation of a knowledge base and system rule base, and identification of outputs. Figure 2 shows the manufacturing flow of the Expert Personality Analysis System that begins with conducting surveys, defining problems, studying literature and collecting data conducted by interviewing an expert, system modeling, database design, interface design, input data provided by the expert, then phases of testing the system where if the system is not running properly then the process is repeated from modeling the system to the system giving the correct results, then to the results analysis stage, and making reports.

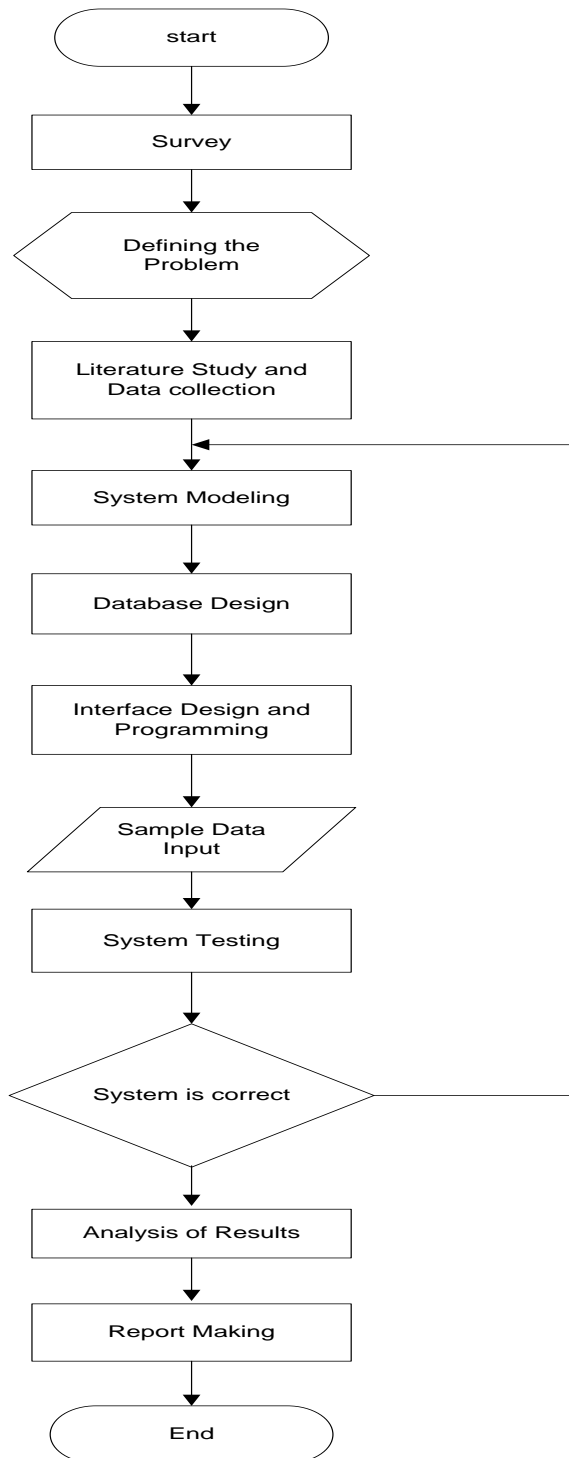


Figure 2 : Flow analysis application system Expert Personality Based on Graphology

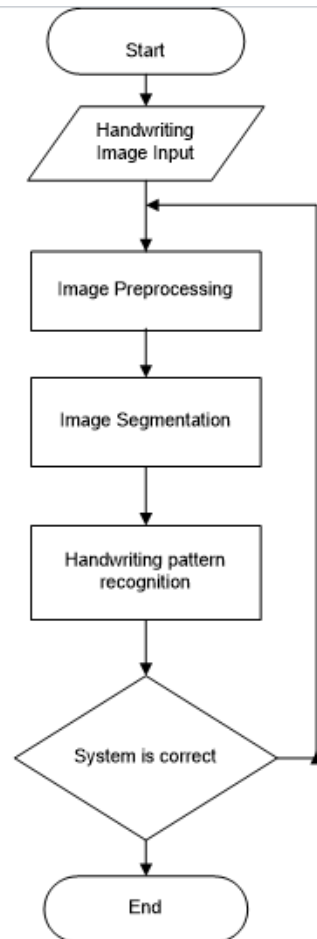


Figure 3 : The flow of the method applied to the image

Figure 3 below is a picture of the flowchart of the image processing that is applied to the German method of Graphology. Pre-processing methods in handwritten imagery that will be used in the German method of Graphology include:

1. **Gray scaling:** Gray scaling is also called gray level image, giving the possibility of more colors. This image format is called gray level because there is a gray color between the minimum color (black) and the maximum color (white).
2. **Thresholding:** The Thresholding process converts an Image into a binary image where a threshold level value is determined then a pixel that has a value below the threshold level is set to a white color value (0 at the binary value) and a value above the threshold level is set to a value black color (1 in binary value). The threshold process is used to extract the foreground (ink) from the background (paper) and make the image binary.

As for the segmentation, it includes:

1. **Marginal segmentation:** The segmentation is done by horizontal and vertical segmentation methods by scanning the points closest to the paper boundary, first scanning the top, right, bottom, left margins and then meeting the meeting points between the lines.
2. **Baseline line segmentation and writing size:** The process is to detect how many lines of text, the method uses horizontal segmentation, each array of posts directly in the calculation of the meeting point, so as to find the height and slope to be calculated so that it becomes average.
3. **Spacing segmentation between words:** The process is the same as line segmentation, the scanning is directed upwards (vertical segmentation), but it must be known in advance how many pixel ranges are considered spaces, pixel range here is white pixels, then from scanning results it is known how much the amount of space and pixel length, to then be calculated so that it becomes average.

IV. Result And Discussion

Expert System of Personality Analysis Based on Handwriting and Signature Graphology is an Expert System that manages certainty and uncertainty data and determines the personality of each person by using comparisons of calculations of Certainty Factor (German Method) and Image processing method (French Method).

4.1 Trial of Handwriting Analysis by the French Method

The handwriting analysis page functions to conduct a personality test that will be carried out by the user. To be able to access the personality consultation page the user must register first then the user must login. Login is done by entering the username and password that the user created when registering. There are two displays of handwriting analysis namely the consultation menu which contains questions about Graphology and the Image Analysis menu which is a menu for analyzing handwritten images uploaded into the expert system. Display the consultation menu and image analysis as shown below.

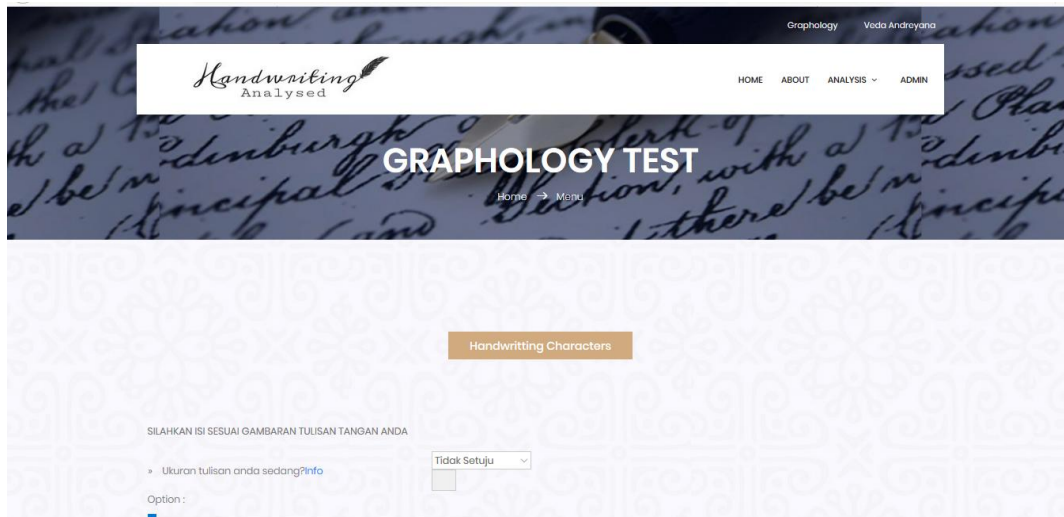


Figure 4 : Graphology consultation page display

Figure 4 is the initial view after the user has logged in. The consultation page will display questions that the user must answer. There are ten answer choice values, such as "Disagree", "Disagree Agree", "Fairly Agree", "Agree", "Strongly Agree". The further button functions to display the next question if the user has answered a question that has appeared in the consultation menu. Figure 5 is a consultation page.

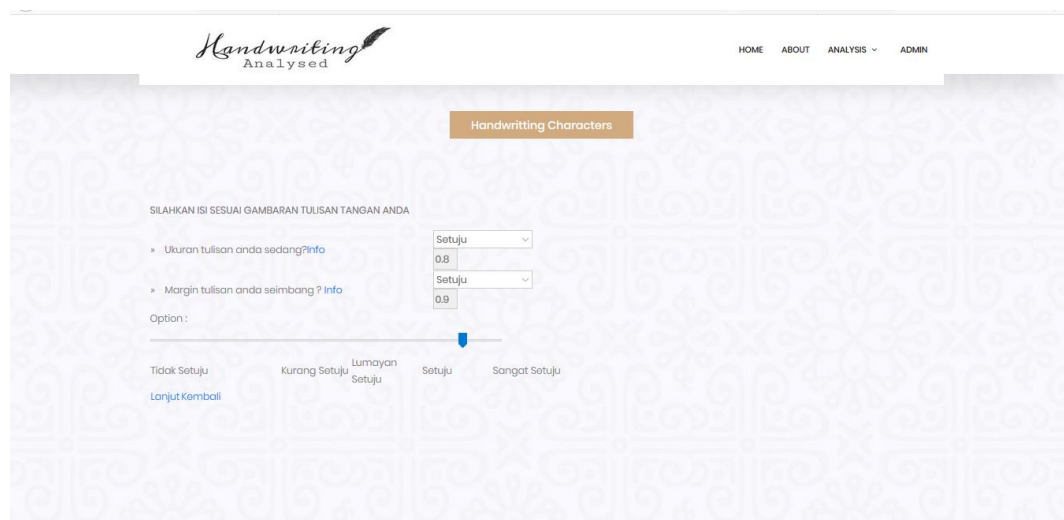


Figure 5 : Personality consultation page display

After the user has finished answering all questions, then on the handwritten personality consultation page will also be displayed Graphology personality consultation results from the user. The percentage of the

value of system trust with the calculation of the Certainty Factor method is displayed to provide how much trust the results of the method. The repeat button is used to repeat the process from the beginning.

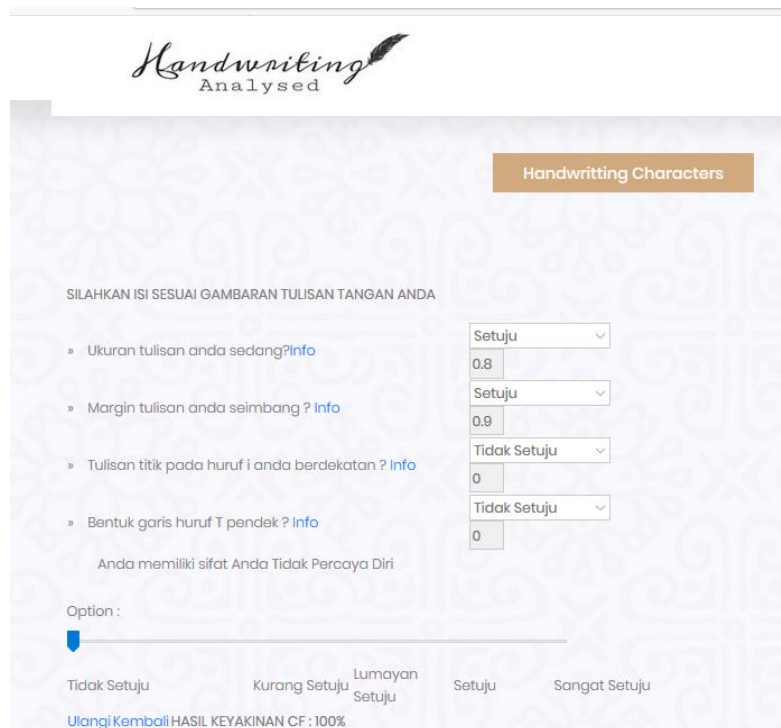


Figure 6 : Display page of the results of personality consultations

The trial results obtained personality with the nature of Confidence. The percentage of confidence gained is 100%.

4.2 Trial of Handwriting Analysis by the German Method

Image Analysis Menu can be accessed by selecting Image Analysis in the analysis view. In this menu the user can upload a handwritten image that the user has previously written on paper which is then photographed or scanned. To be able to upload the largest image resolution size of 1 MegaPixel, if it is greater than the resolution the system will have difficulty in processing images, because the computer or laptop hardware used is very influential with the processing speed of the image and image resolution that can be uploaded to the system. Image analysis menu display as in Figure 7.

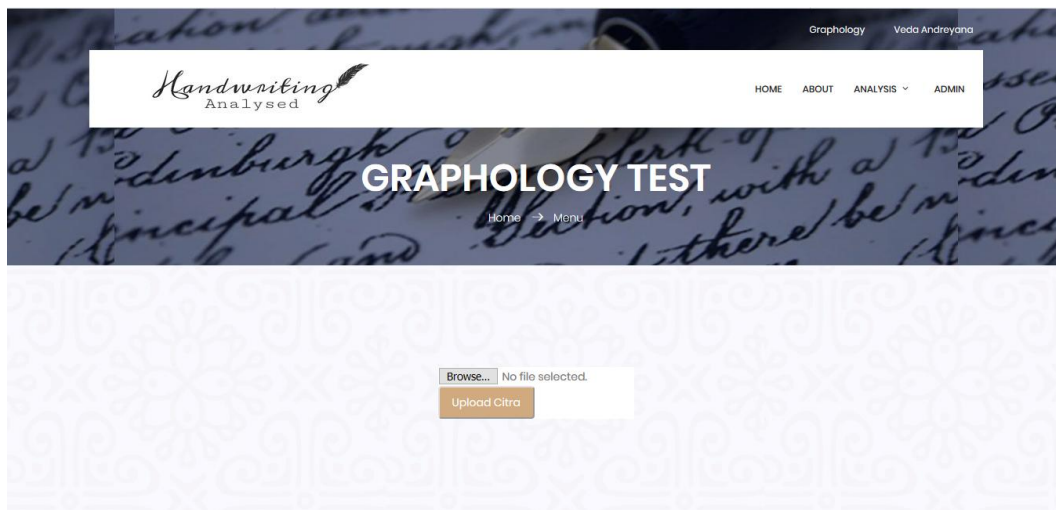


Figure 7 : Image analysis page display

Figure 7 above shows the image analysis menu display, on this menu the user can upload an image (handwritten image) by pressing the browse button. If the image to be analyzed has been selected, then press the Upload Image button to perform the image analysis process. The speed of the analysis process depends on the size (file size and resolution) of the image and the image quality level. The results will be immediately displayed on the image analysis page. An example of image analysis results can be seen in Figure 8

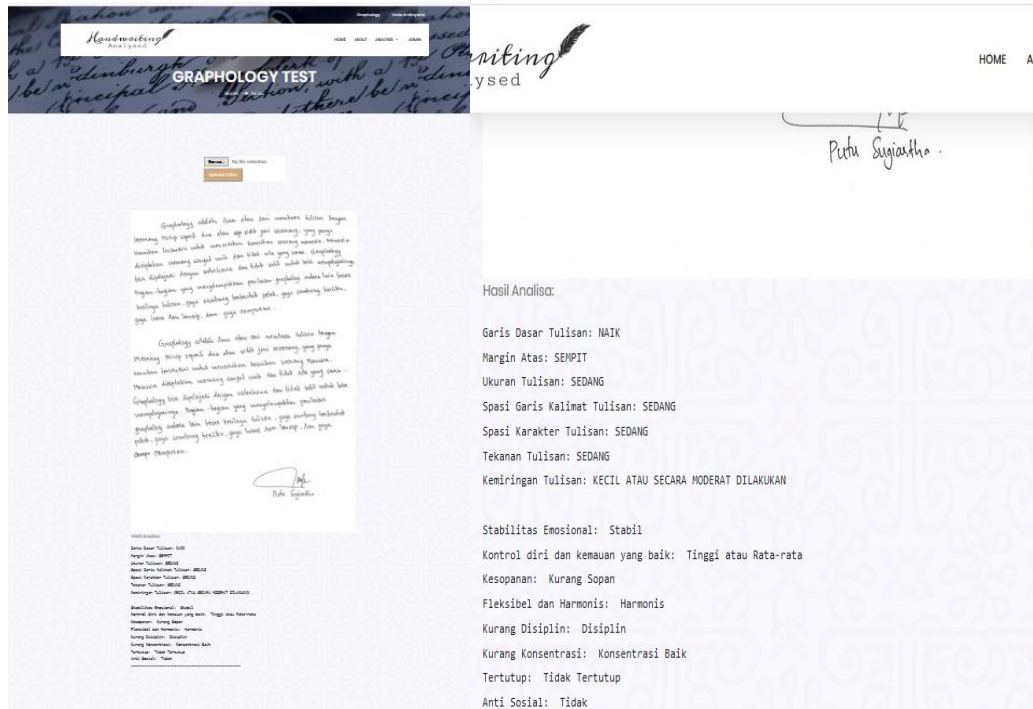


Figure 8 : Display page of image analysis results

Figure 8 above shows the display menu of results from image analysis. On that page displayed the uploaded handwritten image and handwritten character along with the personality of the user.

4.3 System Feasibility Analysis

Some considerations used in the design and manufacture of a Handwriting Graphology Expert System using the Certainty Factor Method and Image Analysis are as follows:

1. Helping users recognize and understand the personality types of themselves and others so that it is easier to communicate, determine career who is suitable, and self-reflecting for the better.
2. The system created helps users to conduct personality tests in a more efficient, accurate, and fast way.
3. The system created helps experts to get fast results without having to use manual calculations.

Based on the above considerations, a system is designed and built to make it easy to obtain information and make personality assessment decisions.

4.4 Experiment

4.4.1 Trial Sample

Testing with several users was carried out on 20 sample people where the data or handwritten characters provided by one user to another to the system are different data. Handwritten character sample data from the user can be seen in table 2

Table no 2: Handwriting Graphology Sample Testing.

Sample	Personality Results German Method	Personality Results French Method
Sample 1	Self-control: High or Average	Self-Confidence
Sample 2	Emotional Stability: Unstable	Your Emotions Are Unstable
Sample 3	Self-control: High or Average-	Self Control and Good WillGood
Sample 4	Self-Control: High or Average-	SelfControl and Good Will
Sample 5	Closed: Unclosed	Characteristic of Confidence
Sample 6	Emotional Stability: Unstable	Your Emotional Characteristics Unstable
Sample 7	Emotional Stability: No Stable	Your Emotions Are Unstable
Sample 8	Less Discipline: Discipline	The Nature of an Idealist
Sample 9	Closed: Not Closed	Open Nature

Sample 10	Closed: Not Closed	Insecurity
Sample 11	Closed: Closed	Traits of a Shy
Sample 12	Closed: Closed Closed	Character
Sample 13	self-control: High or Average-	SelfControl and Good Will
Sample 14	Closed: Not Closed	Sif at a Shy Person
Sample 15	Closed: Not Closed	Open Nature
Sample 16	Closed: Unclosed	Open Properties
Sample 17	Closed: Unclosed	Character of a Shy
Sample 18	Emotional Stability: Unstable	Your Emotional Traits Unstable
Sample 19	Closed: Unclosed	Characteristics of A Person The Shy
Sample 20	Emotional Stability: Stable	Very Self-Confidence

From the data in table 2 above it can be seen if the results of the analysis of handwritten images and the results of handwritten character consultation almost all data samples from the given personality results are the same. So for the accuracy of the analysis results of both the German method and the French method it can be said to be the same. For image analysis, the results of personality character analysis output show more of a person's character type, while for the results of handwritten character consultation only produces one personality type personality output.

4.4.1 Expert Trials

Expert trials were conducted with psychologists on duty at the Bali Mandara Regional Hospital namely Ida Ayu Gede Bintang Praba Dewi, S.Psi., M.Psi., Psychologist. The trial was conducted by comparing the output results of the system with direct reasoning from the experts. Experts try to compare the results of the handwriting samples of 20 people who have been tested with the system with the results of direct expert reasoning analysis. To analyze the results of the system output of 20 samples obtained an accuracy of 80% from experts. For analysis of handwriting consultations with a sample of 20 people, accuracy was 90% from the experts.

V. Conclusion

The conclusions that can be drawn from the creation of a Personality Analysis Expert System based on Handwriting Graphology are as follows: The Expert Handwriting Graphology Expert System is created by modeling a tree. Model tree (tree) to see the results, the search uses recursive functions because the process is done repeatedly and will stop until the conclusion of the personality test has been found. The Handwriting Graphology Expert System is created using image processing methods, some image processing processes are carried out such as Gray-scaling, Thresholding, Segmentation, and Image Training in Graphology data which is done to get the results of personality analysis based on handwritten characters. Utilizing a database in storing the knowledge base of an expert system will make it easier to create knowledge improvement and development facilities. So that the development of the system through the acquisition of new knowledge can be directly carried out in the system. The Handwriting Graphology Expert System makes it easy for people to know their properties based on the Science of Graphology. The sample trial results from 20 people obtained accuracy for the German method by 80% and the French method by 90%.

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