Lobe Software's Accuracy in Analyzing Human Facial Expressions

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***Abstract*— The face constitutes a research subject for analyzing human facial expressions, as it can provide insights into an individual's emotions. Facial expressions are identified through changes in key facial features such as the eyes, eyebrows, mouth, and forehead. The field of education has witnessed rapid technological advancements, especially in light of the pandemic. Consequently, the need for the development of technology has become increasingly pressing. This study aims to evaluate the accuracy of Lobe software in analyzing human facial expressions. The sample population for this research comprised students from IKIP Muhammadiyah Maumere, Indonesia, with a sample size of 19 selected using a simple random sampling method. The results of the analysis showed that the accuracy of the software was pretty good, with a score of 90% for each category of neutral, sad, happy, and angry faces. The questionnaire data analysis yielded a score of 84%, which is only 6% lower than the score achieved through the students' self-reporting, implying an error rate of less than 10% if validated.**

***Index Terms*—accuracy, artificial intelligence, facial expression, lobe software**

I. Introduction

Technological developments in the world of education are happening so fast, especially in education during a pandemic. The development of this technology is needed so that it develops rapidly. Some of the benefits of technology applied to the development of computer vision science are imitating how humans see [1]. Along with the development of the era, technology continues to develop until the creation of other applications such as face or pattern recognition. The use of this kind of technology has great benefits in the world of education, where it will be easier for teachers to recognize students' facial expressions through the implementation of Artificial Intelligence (AI). The use of technology in learning is considered very effective because it is flexible, namely the use of time with appropriate technology [2].

The implementation of technology in the world of education is very broad, one of the benefits obtained is that technology can detect faces to find out how students are. Facial expressions contain a lot of psychological and emotional information [3]. Facial expressions are a visual manifestation of the statements, goals, intentions, personality and psychology of a human being [4][5]. Several facial expressions were categorized in this study, namely neutral, sad, happy, and angry expressions. One that is easy to use in seeing facial expressions is through pictures taken using a camera [6]. The face can be found in several expressions found in a person including smiling, sad, surprised, confused, sleepy, and neutral expressions with the help of eyebrows, eyes and mouth on the face [7]. Facial expression recognition is a challenging problem in technological vision, which has attracted a lot of attention in recent years for its potentially important applications [8].

Many similar studies have been carried out by previous researchers, but most researchers use different applications and software such as Convolutional Neural Network (CNN), Faster R-CNN, and You Only Look Once (YOLO) [9]. Previous research used eigenface/ PCA to detect human faces with maximum and minimum results of $6.0000e^{+04}$ [10]. Research Ref. [11], with the same method and the results obtained show if the image fits in a variety of expressions. Research using methods with almost the same results was also carried out by Ref. [2], This research is more about examining the work system of the method used but has not directly compared it with the real expression of the research object.

Based on the problems that occur, researchers will conduct research using lobe software to detect human facial expressions so that it is easy for educators to know the facial expressions of students in their own class. The way this software works is to combine several images in each category, then the image of the face is trained by the software before displaying the results according to the categories made. Research on facial image identification from the analyzed images is one of the implementations of computer vision and Artificial Intelligence (AI) [12]. Lobe software is software that is available on mac and windows and can be used for learning by utilizing machines. Lobe itself uses an image reader sensor that can translate the image shown and automatically trains and sends data through the applications we used [13].

Lobe is designed with very simple commands so that it is easy for anyone to use and does not require code or even experience, this is clearly different when compared to other software that mostly uses coding. The simple workings of the lobe software are divided into three stages, namely collecting and labeling the images you want to detect, training the model and understanding the results, playing and enhancing then exporting the model.

The purpose of this study was to determine facial expressions using lobe software, where the results analyzed by the software were compared directly to the results of a questionnaire filled out by IKIP Muhammadiyah Maumere students about their facial expressions when they were neutral, sad, happy, and angry. This software also does work not only to recognize faces but to recognize facial expressions. It is clear that the work of the lobe software has

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many advantages that are not used only to detect faces as an attendance requirement [14].

II. METHOD

In general, this research went through several stages including literature study, problem analysis, data collection, facial image testing or training, data processing and conclusions. The research design can be seen in Fig. 1.

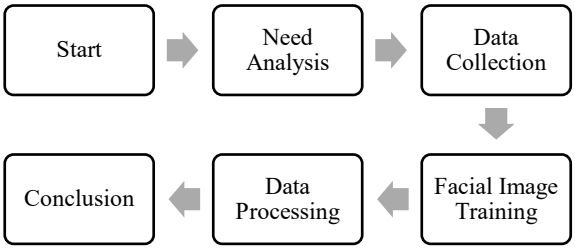

Fig. 1. Research Design conducted

The initial stage of the research, the researcher conducted a needs analysis, the researcher conducted a literature study to find references and studied some of the literature on articles with similar research. Literature study is carried out in various sources such as research journals, books, the internet and other relevant sources. The data collection stage is carried out after conducting a needs analysis. At this stage the researcher prepares images according to the category of facial expressions to be studied. Each face category consists of 5 facial images. In addition, the researcher made a questionnaire according to the collected facial images and will be given to respondents, namely IKIP Muhammadiyah Maumere students as a population. 19 samples were taken using the simple random sampling method, namely part of the probability sample, namely giving the population the same opportunity to be used as a randomly selected sample [15].

The data processing stage is carried out after the train stage is completed. At this stage the images to be processed by the lobe software are prepared in each folder with a predetermined label, each folder has 5 images that fall into the criteria according to the naming label. Labeling of folders can be seen in Fig. 2.

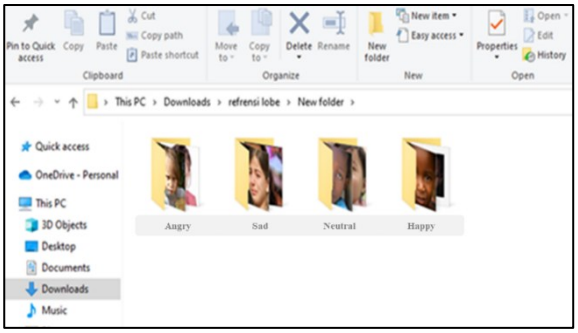

Fig. 2. Image folder to be processed

Processed data were analyzed to obtain data with a good level of accuracy. The accuracy of the data was compared directly with student answers in the response questionnaire distributed by the researcher. From the results of the analysis, conclusions can be drawn about the accuracy of using lobe software in analyzing facial expressions. The questionnaire distributed to students only consisted of 4 questions which were adjusted to the number of expressions displayed and then students chose their facial expressions when in a situation with a certain expression. Questions on numbers can be seen in Table 2.

Table 1. Questions on the questionnaire

No	Question	Figure Number Choice
1.	What is the expression on your face when you are happy	
2.	What is the expression on your face when you are angry	
3.	What is the expression on your face when you are neutral	
4.	What is the expression on your face when you are sad	

Based on the questions in Table 1, students answer and fill in the table based on the expressions in the images that have been distributed as many as 20 types of images according to fig. 6.

The workings of the lobe software are divided into several stages, namely data collection and labeling for each folder consisting of 5 images. Each folder consisting of several images is entered into the software lobe via the import menu. How it works in the first stage can be seen in Fig. 3.

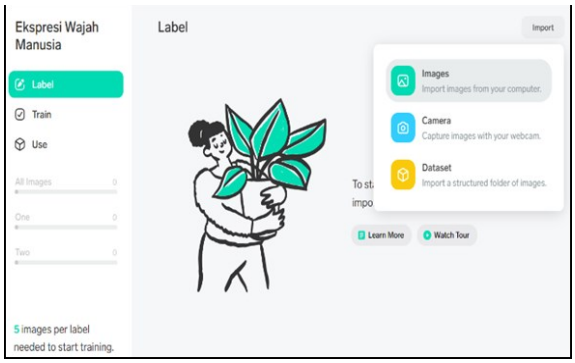

Fig. 3. Image import stage in lobe software

After the data is entered into the software via the import menu, each data is made into the desired category with each category consisting of 5 images which are labeled respectively, namely neutral, sad, happy, and angry labels according to the categorization as shown in Fig. 2. The intended labeling can be seen in Fig. 4.

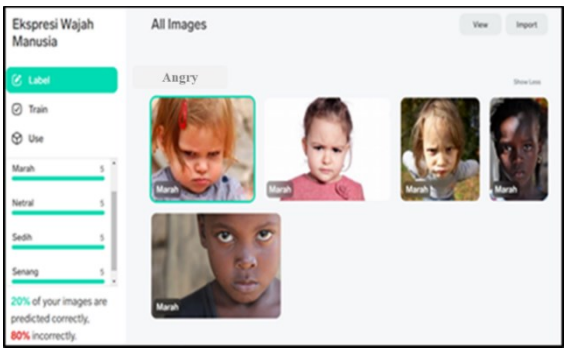

Fig. 4. Labeling of imported images

After the images are imported and categorized by giving a name to the label, then training is carried out to investigate the suitability between the labeling and the analysis performed by the lobe software. After being trained by the lobe software, the results will be read and then the results will be compared again with the questionnaire that was filled in by the students.

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III. Results and Discussion

Obtaining research results is carried out through several stages including searching for images that match the category to be studied. The important thing to do in research is to import the images that the researcher has prepared. The image data that has been imported can be seen in Fig. 5.

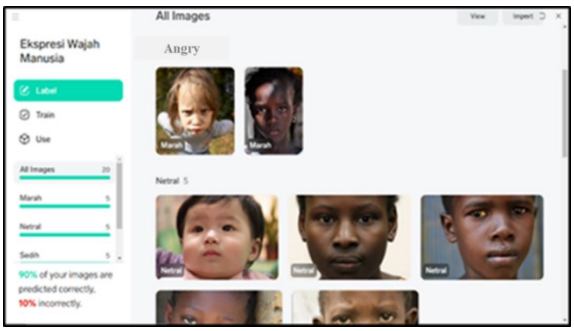

Fig. 5. Image labeling process according to the expression category studied

The imported images are then labeled and trained as a form of data processing performed by the lobe software. The data generated from the train has a report about the value of the image. The results of the image training by the lobe software are then compared with the data obtained from the results of the questionnaire analysis filled out by students. Based on data obtained from a questionnaire filled out by IKIP Muhammadiyah Maumere students. The research samples of facial expression patterns used in this study amounted to 20 facial images representing sad, neutral, happy, and angry expressions. Fig. 6 attaches some samples of facial expression patterns used as research.

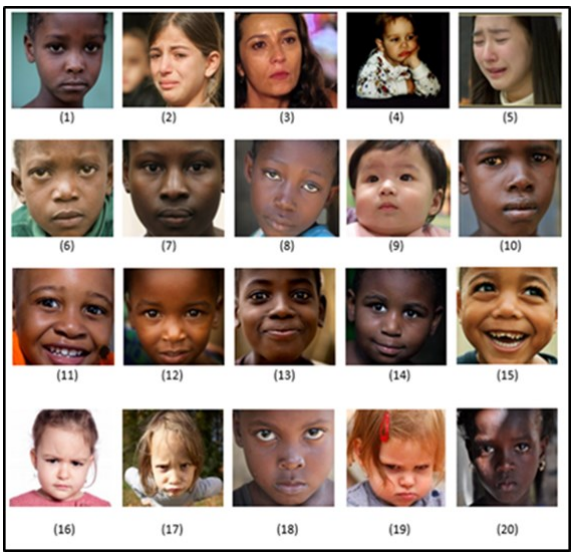

Fig. 6. Sample facial expressions

Based on Fig. 6, each facial expression is coded in the form of a number. Sad facial expressions are coded 1, 2, 3, 4, 5, neutral facial expressions are coded 6, 7, 8, 9, 10, happy facial expressions are coded 11, 12, 13, 14, 15, while angry facial expressions are coded code 16, 17, 18, 19, 20. Each expression with the code that has been made will be adjusted to the questionnaire that the student has filled out.

The student response questionnaire that was filled out shows the harmony of facial expressions shown in Fig. 6 with the real expressions experienced by students when they are in sad, neutral, happy, and angry facial conditions. Students fill in the questions in the questionnaire according to the questions in Table 1. Each image has been designed by the researcher to be presented in the form of a questionnaire that must be answered by respondents. The results of the questionnaire filled out by can be seen in Fig. 7

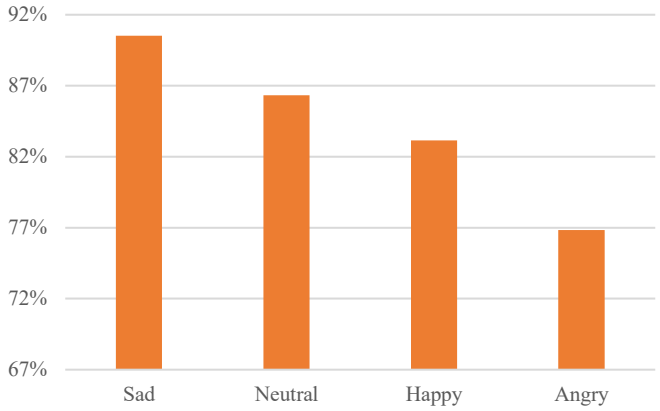

Fig. 7. The results of the facial expression questionnaire

Based on Fig. 7 the results of the questionnaire filled out by students according to the adjustment of their expressions when they are in sad, neutral, happy and angry facial conditions are 91%, 86%, 83%, and 77%, respectively. The value is obtained from the average percentage of the questionnaire results that have been distributed. In the questionnaire, each question was given a column of 5 columns, where respondents were given the opportunity to choose a picture according to their expression if they were in a condition that had been categorized. Each filling in one image will be given 20 points for the correct answer, and if their answer does not match the coding imported into the software, they will be given 0 points and considered as an error.

In addition to the images being analyzed through questionnaires, the images were analyzed using the software provided. The results of image analysis using lobe software after being input according to the conditions that have been categorized and given a number coding can be seen in Fig. 8.

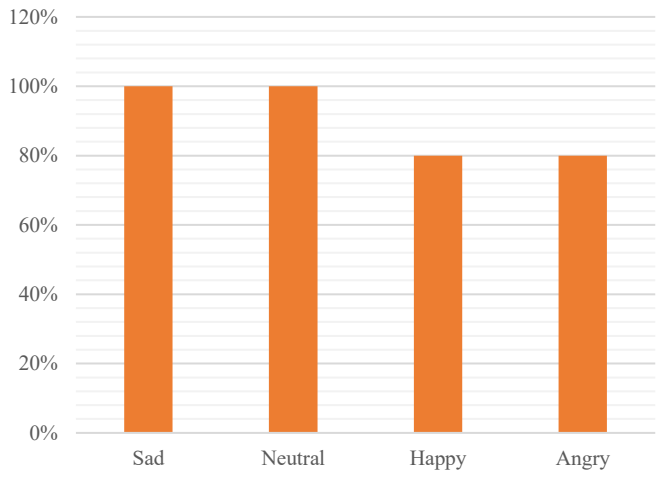

Fig. 8. Results of image analysis using lobe software

The graph shown in Fig. 8 is the result of image analysis using lobe software. After going through several stages of data analysis, the resulting facial expressions are sad, neutral,

happy, and angry, namely 100%, 100%, 80%, and 80%, respectively. The results of the 100% analysis show that the images that were trained on the lobe software have an acceptable suitability as facial expressions with the results of the categorization by the researcher. While the results of the 80% analysis show that one of the 5 images in a certain category has a rejection or recommendation to be placed in another category. This means that according to the train performed by the image lobe software that is read, it tends to be in another category. Software lobe analysis related to this can be seen in Fig. 9.

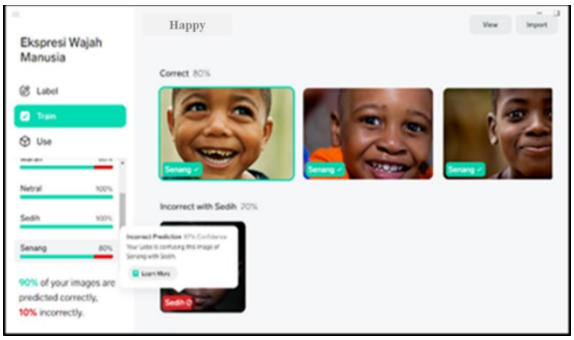

Fig. 9. Description of the results of image analysis

Fig. 9 determines the results of image analysis for the happy category. 80% of the images were reported as appropriate from facial image reading while 20% had discrepancies and were recommended in the sad category.

The results of processed data using lobe software will be re-analyzed based on the clusters obtained as shown in Table 2.

Table 2. Clusters of lobe software test results

Facial Expressions	1 Sad	2 Neutral	3 Happy	4 Angry	Number of Clusters
Sad	5		1		6
Neutral		5		1	6
Happy			4		4
Angry				4	4
Percentage	100 %	100 %	80 %	80 %	

Based on Table 2, the test results of the lobe software are shown which consist of testing of an approach consisting of testing images that detect appropriate facial expressions and testing images that do not detect facial expressions. the performance of the lobe software was tested on 20 sample images of facial expressions, the test is displayed in the form of examples of detected and undetected image results of the corresponding facial expressions.

Of the 20 sample images that were divided into 5 images for each category, there were 2 images that did not fit, namely happy and angry facial expressions, then it was recommended that based on the results of lobe software analysis, they were in the sad category for 1 image of happy facial expressions and neutral for 1 image of angry facial expressions. The use of this software is important to correct errors in analyzing facial expressions because they are immediately corrected and recommended [16].

Comparison of the average percentage of data obtained from the results of the questionnaire and the results of the lobe software training for each category of facial expressions can be seen in Fig. 10.

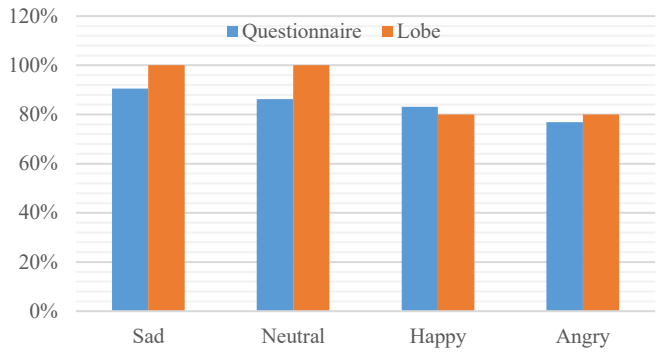

Fig. 10. Category average comparison Questionnaire facial expressions and lobe software

Meanwhile, the average results of the questionnaire analysis and lobe software can be seen in Fig. 11.

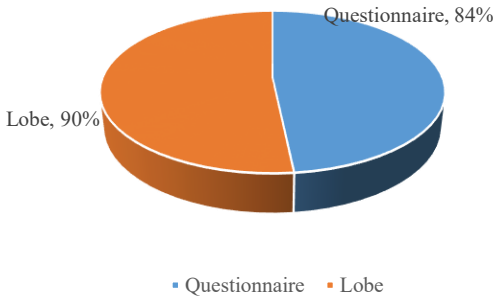

Fig. 11. Average results of questionnaire data analysis and lobe software

Based on Fig. 11, the level of accuracy of lobe software is around 90%, meaning this can be done for further research such as detecting student expressions during the learning process. This is not much different from the results of filling out a questionnaire conducted by students, which has a difference of 6%, meaning that the error rate if validated does not reach 10%. The level of accuracy that is owned up to 90% is better when compared to other studies using different software.

This is in accordance with research Ref. [17] which has 67%-83% when using other software that is not lobe software. From the level of accuracy possessed by the lobe software, it can be recommended as software that detects expressions in police interrogation, the results of which are much better than the results of research that has been done before [18]. The results of the research conducted have nearly the same accuracy as the research Ref. [19] diagnosing a patient's disease by a doctor with an accuracy rate of up to 90%.

In addition, lobe software is very easy to use for beginners without having to study harder because using this software does not require complicated coding like other face detection software. Research Ref. [20] those who use Yolov5 to analyze the depth of expression must have special skills because they must be able to operate coding. As stated in the research Ref. [21] said that the use of other software that is not lobe requires quite a large amount of hardware resources and the use of complex coding in predicting expressions.

Some of the results and comparisons obtained, the results of this study can be recommended to be applied to the

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educational environment. For example in detecting students' facial expressions in online learning [22]. As in another study Ref. [23] which detects the state of the driver on the street for safety. The most important is recommended for education [24][25] because teachers can know students' expressions when learning is difficult [26] and can easily detect emotional situations experienced by students [27].

IV. Conclusion

Based on the findings of this study, it can be inferred that the utilization of Lobe software in detecting facial expressions across the four categories, namely sad, neutral, happy, and angry, yields a high level of accuracy of 90%. Furthermore, the results obtained through facial image training using Lobe software exhibit a relatively minor variance of 6% from the data gathered through the questionnaire. Moreover, the software's user-friendly interface and accessibility make it an excellent tool for beginners without any prior expertise. This may serve as a new and innovative approach for educators to monitor students' facial expressions during classroom learning.

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