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***Abstract*— Technology has improved a lot comparing to the previous years. The improvement can be seen from various development of a program that may benefit human life. One example of the advancement of technology is artificial intelligence (AI). AI has taken a considerable part in becoming the primary necessity in computer programming. One famous example of AI is object recognition. An arrangement of codes is established for the machine to recognize a picture that is inputted. Even so, the use of object recognition programs that may help mental disorder children is still low — considering that they are still in the age where education is crucial. However, the standard approach of teaching them is not the right way to make them understand since they need individual adjustments and appropriate training for them to follow. Therefore. We are proposing an application that will help to educate mental disorder children through the use of object recognition in visual learning. The app will have built-in features such as vocalize the object's name, which will help mental disorder children to know and remember how it is pronounced. Other features to further improve the education has guessed the word and draw the object which will help them to understand how the object is shaped. Moreover, Researches have proved that learning visually will help mental disorder children to understand better.**

Keywords*— *object recognition, mental disorder children, visual machine learning, visual learning

I. Introduction

Technology has advanced at an incredible speed, which also increases the need for it too. The rise of demand in technology can be seen in various forms that can do many things, especially helping human needs. One example of technology's growth is Artificial intelligence (AI). Artificial intelligence is a field of study which learns how a computer interacts with human as if the human is communicating with another human. Moreover, many applications are now applying artificial intelligence as their base program.

Meanwhile, growing children continuously detect objects on their surroundings, and sometimes they do not know what is/are the object(s) they are looking for. Nowadays, kids have already held their gadgets even at their early ages [1][2]**.** The result of a survey conducted, 96.6% of children had used a mobile device, and the remainder had never used [1]. Therefore, it is not only limited to the things that they detect on their surroundings, sometimes things that are available on the internet too. Unfortunately, this does not apply to mental disorder children as they cannot use gadgets effectively, and even some of them are still struggling to dress or eat on their own. Without proper guidance, they will not be able to process the information correctly.

Therefore, in this paper, we create an artificial intelligence program that can give proper education for mental disorder children through visual learning. Our application will be able to scan nearby objects from the device's camera and provides detailed interactive information about the object to make it easier for them to understand. It is also able to analyze the picture that is uploaded to the application. This is where object recognition plays its role to help explain the object. We are hoping that

this kind of program will help expand the knowledge and hopefully educate mental disorder children properly.

II. Problem Definition

Mental disorder is the lack of intelligence that affects the ability to relate or understand information [10]. Surprisingly, more than 8 million children in Indonesia are categorized as mental disorder children [11]. Without proper education, they will not be able to grow. Moreover, since children are still in the developing age, the information they intake at that age is relevant. The significant development of information that is available on the internet may be the key to enrich the knowledge of the young generation [2]. However, the information provided on the internet may be too hard for mental disorder children to understand since some of the reports are using complicated vocals where it may hinder mental disorder children to learn. Even if the information that is offered on the internet is enormous, but if it is delivered not using an interactive design to help them understand it better and information with easy to understand words, they will not be able to absorb the knowledge correctly.

Furthermore, children and especially mental disorders children will learn it better if the information is provided withdrawing or other multimedia [3][4]. A study has also proved that mental disorder children will understand it better if the information given is provided with images and easy to understand the word [9]. Even though technology has improved a lot compared to the years before, Artificial Intelligence is still hard to find and is still limited in function, including the use of AI in object recognition programs for education [7]. We can see this clearly in the lack of applications that can identify and analyze objects.

Ultimately, based on all these statements, in this paper, we are trying to find the right answer to solve these problems such as, how to implement an artificial intelligence program to recognize and analyze objects that can act as an excellent educator for mental disorder children? Are mental disorder children able to learn quickly through visual learning and easy to understand words?

III. Current Implementation

Technology has taken a revolutionary step, which is shown in the advancement of applications that are using Artificial Intelligence (AI). AI can handle many data, processing it, and later will return result/s or even prediction/s. However, as advanced as it is, it still needs improvement, especially in the application that uses AI to recognize an object or as we are more familiar with, object recognition. Nowadays, we can see a lot of implementation of AI in various applications, but most of them are still limited in feature and if worse, limited in its accuracy [7].

Before we proceed further, let us first understand the logic behind Artificial Intelligence, how can the program identify an image, process it, and return the correct result. We, humans, are capable of the discerning object immediately depending on our knowledge. This is the result of our brains. Explicitly, the neurons which are capable of receiving input, pass the information, and process it. This also works the same in Artificial Neural Network (ANN) algorithm as one of the examples of AI algorithm implementation. ANN uses our brains as its model to create a synthetic version of our neuron systems [5]. AI is recognized as the machine capacity as data mining (the capability of a device to recognize a pattern in a large sum of data) and as machine learning (the ability to adapt and learn based on previously given data without it being programmed initially).

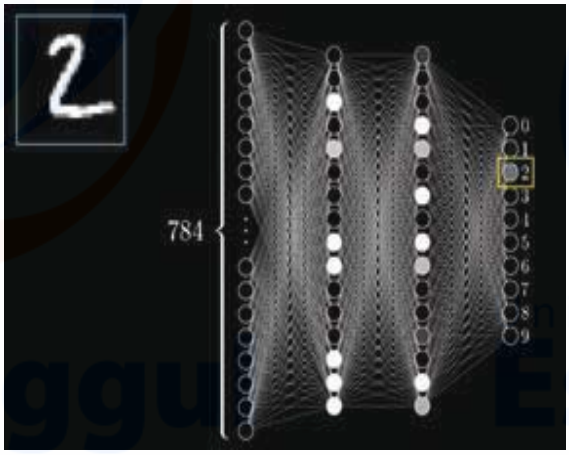

Figure 1. FNN Structure, [Retrieved from 3blue1brown.com]

One of the simplest types of ANN is FNN (Feedforward Neural Network) and is the critical logic of every object recognition (although other object recognition programs may use a different kind of Neural Network its logic will remain the same with FNN logic). Feedforward Neural Network is composed of layers, with each segment is assigned to a different task. The first layer is the input layer; this layer is comprised of many nodes that are responsible for the pixels in an image [5][6]. The last layer is called the output layer; it is reliable in handing out the result [5][6]. The output layer may consist of one or more nodes. Each of the nodes represents one consequence depending on the input. Lastly, In

between the input and output layer, stand the hidden layer. It may consist of one or more layers depending on the structure of the network and usually is tasked to classify the input based on its feature.

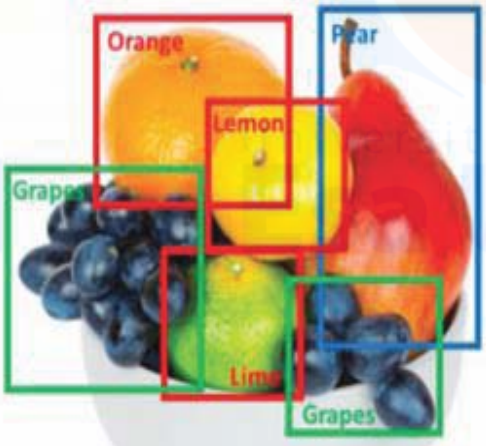

Figure 2. Google object recognition result, [Retrieved from www.ireviews.com]

The 784 nodes (Figure 1) in the input layer are the total pixels in the "2" image [8]. Every node holds a certain number (between 0 and 1) called the activation and is determined by how "bright" a particular pixel is in the image. Each of the nodes in one layer is connected to all of the nodes in the next layer, which is responsible for the "activation" of the nodes. The activation will be passed to the next layer and light up the corresponding nodes and will hopefully light up the "2" in the output layer later. To distinct, every node from each other, biases are set to each of the nodes and will affect the calculation of the activation function [5][6]. Now that we have understood the logic and the computation behind object recognition, it is time to move to the implementation of the logic.

Figure 2 is an example of the accessible object recognition program, the google reverse image search. The google reverse image search is a program that is created by Google that uses the TensorFlow library (Python) to help identify the picture that is inputted by the user [7]. It will analyze the pattern and return a result in the form of an identical or similar pattern (usually in the way of links or similar images depending on the effect of the application). Python is a language that is well-known for its capability that supports an Artificial Intelligence program, and a lot of current object recognition is using Python language.

IV. Proposed Idea

Figure 3. Airplane, [Retrieved from www.whec.com]

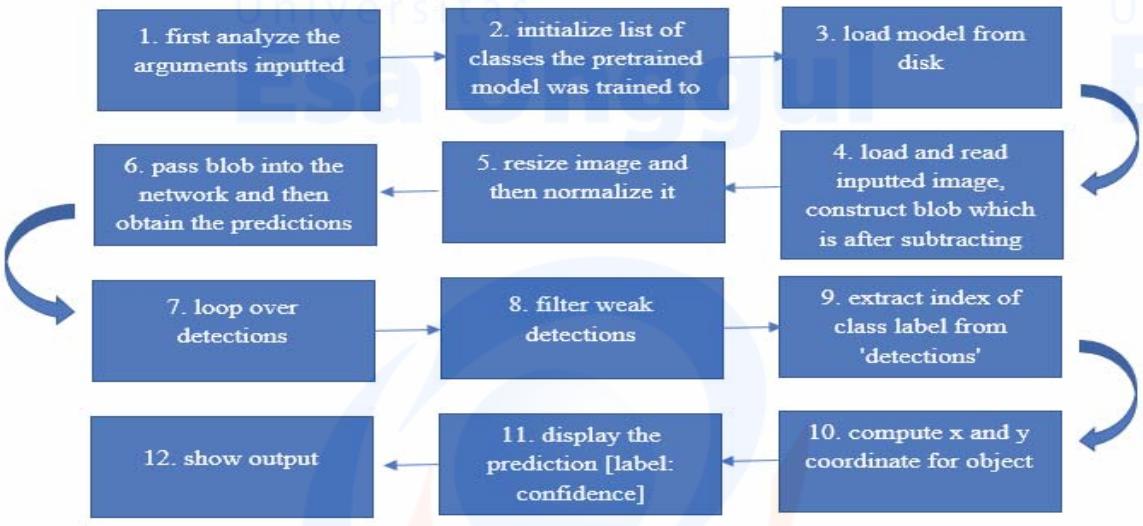

Figure 4. Object Recognition algorithm

After understanding the current situation of object recognition, we are proposing to make a mobile application that can utilize its camera to detect and recognize objects in real-life to educate mental disorder by showing a description of the image. The app then gives the username of the object and its report to the user. It will also offer features that can support the process of studying for mental disorder children such as draw the object, guess the word, and animations.

Suppose we have the image in figure 3 and we want to identify what object this image is. First, we input the image to the application. The application will break down the picture into various patterns, analyze it, compare it to the database of the system, and then hand the result. Below is the complete algorithm of an object recognition program.

In building the application, simple image recognition is used. The steps are according to the image provided above (Figure 4). First, we analyze the arguments that are inputted through the command line. After that, the application will then initialize the classes that were used to train the model and load the model itself. The next step is converting the image into a blob after resizing and normalizing the image. The blob will then be passed down the network to be processed. The system will return a list of detections that need to be looped over and filtered to get rid of weak screenings that are likely to be wrong. Lastly, the index of a class will be extracted from the detections and rendered on the screen accordingly. After understanding the algorithm of the program, we can put our program to test

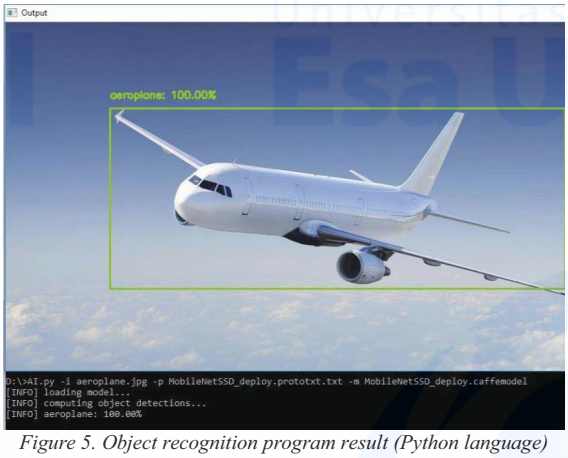

Figure 5. Object recognition program result (Python language)

Our program will return a percentage of accuracy to indicate the certainty of the program after it identifies the corresponding image together with the name of the object. From here on, we can quickly expand the application that includes a friendly and straightforward description of the image by using the label. Many features will then be created based on these results. The drawing element can be introduced by using an edge detection algorithm on the image to create a coloring or a trace-the-line feature. Guess the word function can also be made by merely erasing a few alphabets from the label and make the user guess for points. Animation can be added by using stock animations.

V. Visual Learning Implementation

After knowing how the program works, it is best to understand how it will help to educate mental disorder children in learning. As it has a purpose above that mental disorder children will understand visual learning better than other learning styles because the information is delivered together with other multimedia elements [9], so our program is made as interactive and user-friendly as possible. After an image is scanned from the camera on the device, the program will return a percentage of accuracy along with the name and details of the object. This will ensure the mental disorder to not only know what the name of the object is but also to understand the object.

Figure 6. UI of the Application

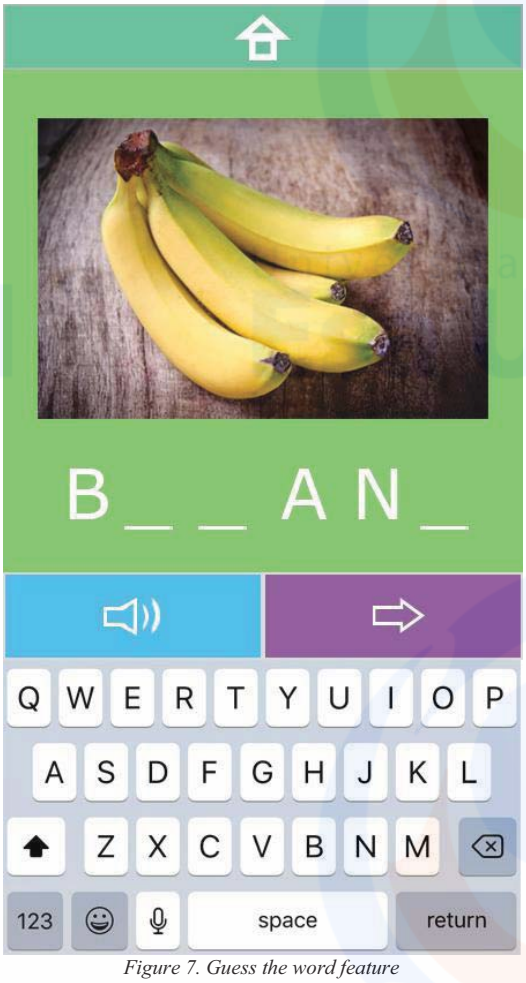

Figure 7. Guess the word feature

In figure 6, we can see the user interface of the application. The home button at the top is to go back to the menu of the application. The name of the object scanned will be available in the middle below the picture that was scanned or inputted. Next, the program will vocalize the object's name; the objective of this voice feature is to help mental disorder children to know how it was pronounced to improve their memory whenever they hear it again. This vocalization can also be repeated with the button with a speaker symbol on it. The application will return detailed but easy to understand information inside the green box in the middle. The information provided will be helping mental disorder children to realize what relevant information the object contains, say for example banana, banana is right for your body, it includes a lot of vitamin B or any other relevant information which will be delivered in a concise and straightforward wording.

The arrow button here is representing. Next, it means to upload or take another picture. When the arrow button is pressed, every image will be stored inside the database. This is done so that the application will have content to teach the mental disorder children in other features such as guess the word which will be discussed further later. The program also has a function to draw or trace-the-line feature the object it scanned to further improve children's memory into remembering the object.

Guess the word (figure 7) is also part of the feature where children need to fill some blank parts of the word and guess the object. Another multimedia element that will accompany the function and to help mental disorder children to think the right word is to listen to the word. It can be done using the blue button on the left side. Another feature such as draw the object or trace the line of the object is also available (figure 8). This is to improve the interactivity of the application further and to help mental disorder children to remember how the object is shaped. Draw the object feature will have an automatic transition between horizontal and vertical mode depending on the picture's shape.

VI. Conclusion

The use of object recognition programs that may help mental disorder children are still low. Therefore, the proposed application that can educate mental disorder children through the use of object recognition is essential. When an image is scanned through the camera, it will detect the objects in the picture, analyze it, and gives information related to it with other built-in features available. The application is also interactive and easy to use to make it more user-friendly.

Figure 8. Trace the line or draw the object feature

References

1. H. K. Kabali, M. M. Irigoyen, R. Nunez-Davis, J. G. Budacki, S. H. Mohanty, K. P. Leister, and R. L. Bonner Jr,

"Exposure and Use of Mobile Media Devices by Young Children," *Pediatrics*, vol. 136, no. 6, pp. 1044-1050, 2015.
2. D. Kardefelt-Winther, "How does the time children spend using digital technology impact their mental well-being, social relationships, and physical activity?: An evidence-focused literature review,", *Unicef-irc.org*, 2017. [Online]. [Innocenti Discussion Paper 2017 - 02] Available: https://www.unicef-irc.org/publications/pdf/Children-digital-technology-wellbeing.pdf. [Accessed: 28- Oct- 2018].
3. R. H. Ibrahim and D. H. Hussein, "Assessment of visual, auditory, and kinesthetic learning style among undergraduate nursing students," *Int J Adv Nurs Stud*, vol. 5, no. 1, pp. 1-4, 2016.
4. S. Schmidgall, A. Eitel, and K. Scheiter, "Why do learners who draw perform well? Investigating the role of visualization, generation, and externalization in learner-generated drawing", *Learning and Instruction*, [Vol. In press] 2018.
5. M. Zakaria, M. AL-Shebany, and S. Sarhan, "Artificial Neural Network: A Brief Overview," *Journal of Engineering Research and Applications*, vol. 4, no. 2, pp. 7-12, 2014.
6. B. Kumar Sinha, A. Sinhal and B. Verma, "A Software Measurement Using Artificial Neural Network and Support Vector Machine," *International Journal of Software Engineering & Applications*, vol. 4, no. 4, pp. 41-52, 2013.
7. J. Mamrosh and D. Moore, "Using Google Reverse Image Search to Decipher Biological Images," *Current Protocols in Molecular Biology*, vol. 111, no. 1, pp. 19.13.1 - 19.13.4, 2015.
8. C. Szegedy, A. Toshev, and D. Erhan, "Deep neural networks for object detection," *Advances in neural information processing systems*, pp. 2553-2561, 2013.
9. Liaison and Diversion, "Learning Disability," 2015.
10. T. S. Sularyo and M. Kadim, "Retardasi Mental", *Sari Pediatri*, vol. 2, no. 3, pp. 170-177, 2000.
11. Kementrian Kesehatan RI, "Situasi Penyandang Disabilitas", Buletin Jendela Data dan Informasi Kesehatan, Jakarta, 2014.
12. A. Singh and A. Sharma, "A Survey on Object Detection, Classification and Tracking in Video," *IJPEMSH*, vol. 3, no. 2, pp. 14-19, 2017.
13. Nidhi, "Image processing and object detection", *International Journal of Applied Research*, vol. 1, no. 9, pp. 396-399, 2015...
14. L. A. Elrefaei, M. O. Al-Musawa, and N. A. Al-gohany, "Development of an android application for object detection based on color, shape, or local features", The International Journal of Multimedia & Its Application, vol. 9, no. 1, pp. 21-30, 2017.
15. A. Chavan, D. Bendale, R. Shimpi, and P. Vikhar, "Object Detection and Recognition in Images", *International Journal of Computing and Technology*, vol. 3, no. 3, pp. 148-151, 2016.
16. S. Dhamale, P. Waghmare, T. Gaikwad, K. Yadav, and S. A. Ghadling, "A Recent Study on Object Recognition for Visually Impaired Persons Using Smart Phone", *International Journal of Advanced Research in Computer Science and Management Studies*, vol. 3, no. 2, pp. 61-65, 2015.
17. K. P. Bhure and J. D. Dhande, "Object Detection Methodologies for Blind People", *International Journal on Recent and Innovation Trends in Computing and Communication*, vol. 5, no. 1, pp. 194-198, 2017.
18. A. Dongre, D. Purandare, J. Gandhi and S. Adak, "Real-Time Detection and Recognition of Hand Held Objects to Assist Blind People", *International Journal of Advance Engineering and Research Development*, vol. 4, no. 5, pp. 0-5, 2017.
19. G. Sharma, A. Gupta, and R. Malik, "Shape based Object Recognition in Images: A Review", *International Journal of Computer Applications*, vol. 58, no. 21, pp. 8-11, 2012.
20. S. Loussaief and A. Abdelkrim, "Machine Learning framework for image classification", *Advances in Science, Technology and Engineering Systems Journal*, vol. 3, no. 1, pp. 0-10, 2018.
21. G. Singh and J. Kaur, "Survey of Image Object Recognition Techniques", *International Research Journal of Engineering and Technology*, vol. 4, no. 1, pp. 194-200, 2017.
22. M. Nijim, R. D. Chennuboyina, and W. A. Aqqad, "A Supervised Learning Data Mining Approach for Object Recognition and Classification in High Resolution Satellite Data", *International Journal of Computer and Information Engineering*, vol. 9, no. 12, pp. 2516-2520, 2015.
23. A. F. Adrakatti, R. S. Wodeyar, and K. R. Mulla, "Search by Image: A Novel Approach to Content Based Image Retrieval System", *International Journal of Library Science*, vol. 14, no. 3, pp. 41-47, 2016.
24. D. N. Parmar and B. B. Mehta, "Face recognition methods & applications", *International Journal Computer Technology & Applications*, vol. 4, no. 1, pp. 84-86, 2013.
25. M. J. Marquis, "The Movidius Neural Compute Stick by Intel", *iReviews*, 2018. [Online]. Available: https://www.ireviews.com/review/movidius-neural-compute-stick. [Accessed: 30- Oct- 2018].
26. "US lawmakers scuttle plan to limit airline change fees", *WHEC*, 2018. [Online]. Available: https://www.whec.com/national/us-lawmakers-scuttle-plan-to-limit-airline-change-fees/5080968/. [Accessed: 30- Oct- 2018].
27. 3Blue1Brown, *But what *is* a Neural Network? | Deep learning, chapter 1*. 2017.
28. G. Shabiralyani, K. S. Hasan, N. Hamad, and N. Iqbal, “Impact of visual aids in enhancing the learning process case research: district Dera ghazi khan.”, *Journal of Education and Practice,* vol. 6, no. 19, pp. 226-233, 2015.