Proceedings of the 2nd Faculty of Industrial Technology International Congress
International Conference
Bandung, Indonesia, January 28-30, 2020
ISBN 978-623-7525-37-0

Detection of Decreased Kidney And Lung Function Through the Iris of the Eye Using the Method Convolutional Neural Network (CNN)

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Abstract

Iridology is a scientific study of the shape and structure of the iris that can provide an overview of every organ in the human body. Research on computerized iridology has been carried out. Cases of decreased organ excretion through iridology that are commonly found are the organs of the lungs and kidneys. The purpose of this research using a deep learning approach namely Convolutional Neural Network to detect decreased organ function in the lungs and kidneys through the iris of the eye. The study of iridology and iris image obtained from iridologists. The cropping method is used to extract the identified part of the eye image. The cropping method consists of a median filter to remove noise, a hough circle transforms to get an iris circle and a region of interest to get the identified part. Image cropping results are used as training data and test data. The Convolutional Neural Network training process uses the VGG16 model with 2 classes, normal and not normal. The results of Convolutional Neural Network research can detect decreased organ function in excretion through the iris of the eye. From 40 testing data with details of 20 right eyes and 20 left eyes, the accuracy is 90%.

Keywords: Iridology, Human Iris, Excretion, Convolutional Neural Network, deep learning

1. Introduction

In recent years, naturopathic practitioners have renewed interest in a disease recognition method that is based on detailed characteristics of the human iris. Iridology represents the study of carefully mapped sections of the iris and the assigned organ systems represented by those areas. There is much research looking for a relation between disease and human iris.

One case that is quite commonly identified through the iris is an organ in the excretion system. The excretory system organ that has decreased function such as kidneys, lungs, liver, and skin have identical patterns and colors on the iris of the eye. Cases of decreased organ excretion through iridology that are commonly found are the organs of the lungs and kidneys. The rapid development of technology gave rise to a method with a high degree of recognition of patterns that is the Convolutional Neural Network (CNN). CNN is one method that can be used to detect and recognize an object in a digital image. Deep Learning is one of the sub-areas of Machine Learning. Basically, Deep Learning [3] is the implementation of the basic concepts of Machine Learning which implements the ANN algorithm with more layers. The number of hidden layers that are used between the input layer and the output layer, then this network can be said to be a deep neural net. In the last few years, Deep Learning has shown outstanding performance. This is largely influenced by stronger computational factors, large data sets, and techniques for training deeper networks [1]. CNN's ability is claimed as the best model for solving object detection and object recognition problems.

2. State of the art

Research on the detection of the condition of the pancreatic organs through the iris with the title "Detection of the Condition of the Pancreas Organs Through the Eye Iris Using Artificial Neural Networks (ANN) Back Propagation Method by Characterizing the Gray-Level Arum Co-Occurrence Matrix" [1]. The image is then

performed by the process of localizing the iris, the organ making pancreatic ROI, and extracting the GLCM feature. The feature extraction results are used as input data (training data and test data) for the back propagation neural network method and then used to diagnose the condition of the pancreas, which is normal or abnormal. The feature extraction results are used as input data (training data and test data) for the back propagation neural network method and then used to diagnose the condition of the pancreas, which is normal or abnormal. Based on the results of the test training data, the program can make a correct diagnosis on the data entered with a 95.8% success rate. While based on test results of test data with a 75% success rate.

Research on the identification of the decline in kidney organ function conditions through the iris with the title "Identification of the Reduction in Functioning of the Kidney Organs through the Iris Eye using the Learning Vector Quantization Artificial Neural Network Method" This study was conducted to making software support modules to detect the deterioration in the function of kidney organs in the human body using the principle of iridology. Iris data is processed using canny edge detection feature extraction to obtain matrix or vector images as an input of artificial neural networks. The method in this study uses a learning vector quantization artificial neural network to recognize the pattern of kidney organs. The results of the network training achieved 100% accuracy with training data, while testing achieved an accuracy of 93.75% with test data.

Research on identification of colon disorders based on iris image with the title "Identification of Colon Disorders based on Iris Eye Image Using the Naïve Bayes Method" [2]. The method used in this software is the Bayesian Method. This method processes the iris image pixels according to the largest frequency, then calculates the probability of each category. This method will produce the probability value of each pixel of the iris image of the eye that has been previously trained to be used in the test image. The iris image database used is Ubiris V.1. This image database is a collection of grayscale images with a size of 200x150 px. Research on the detection of disorders of the gastric organs through iris images with the title "Detection of Disturbances in the Gastric Organs through Iris Eye Images using the Backpropagation Artificial Neural Network (ANN) Method" [1]. This study created a system that can detect the presence or absence of interference with the gastric organs in a person's body. Then the system can perform feature extraction with the Principal Component Analysis (PCA) method and classify it using Back propagation Artificial Neural Networks.

Research on the iris segmentation of kidney disease sufferers [6] requires 4 general stages, namely segmentation, normalization, extraction, and matching. In this study, researchers conducted a study of kidney disease datasets using the hough transform and integrodifferential methods by only focusing on the segmentation stage. From the 19 iris images tested, the accuracy rate obtained was 5.26%, while the integrodifferential operator method was 42.10%.

Research on the identification of disease patterns in iris images with RBF neural network [4] recognizes patterns that appear on the iris can be identified with the help of artificial neural network technology, one of which is the RBF method used in this study. The results found in this study are the use of the RBF method can recognize patterns in the iris of the eye, and can provide the results of recognition of complex diseases and stress with an accuracy that is practically still average (around 50%).

3. **Iridology**

Iridology or commonly referred to as iris diagnosis is a medical method that states that each part of the body can be represented by the region contained in the iris (the colored part of the pupil) [5]. The real originator of Iridology was a Hungarian physicist named Ignatz von Peczely. Iridology is science and practice that can reveal inflammation (inflammation), accumulation of toxins in tissues, glandular dams (congestion), where it is located (in which organs), and what is the severity of the condition (acute, subacute, chronic and degenerative) [6] By observing the iris, through a person's body condition can be known, for example, the status is weak or strong, the level of health and the transition to the severity or healing process. The following chart is Dr. Iris's eye map Bernard Jensen, D.C., Ph.D. with an update from Ellen Jensen, Ph.D., D.Sc., commonly used today.

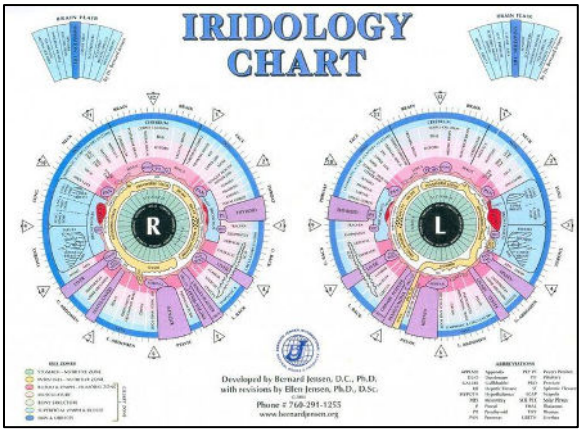


Fig. 1: Iridology Chart

Iridology charts are drawn in a clockwise area. Right-sided iris area showing the kidney was found at 17:30. The right iris area showing the condition of the lungs is at 20.50. The iris area of the left eye that shows the condition of the kidney organ is found in the area of the clock at 18:36. The left iris area showing the condition of the lungs is at 2:15.

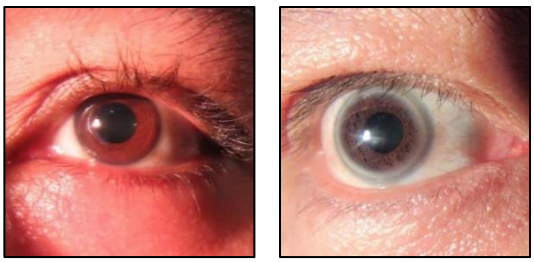
4. Result and discussion

The data that has been obtained is classified into right eye iris and left-right eye iris. Modeling iridology patterns with 200 iris images divided by 100 iris irregular images showing abnormalities and 100 iris images normal. From each modeling, the data will be divided into training and test data. The ratio of training and test data comparison for each model is 80:20.

Table 1: Training and testing dataset

Image data	Training Data	Testing Data
Normal iris	80	20
Abnormal iris	80	20

Normal iris with an iris that has damage there is a difference in the structure of the surface layer of the iris. From the color, texture, and location of patches of pigment in the iris, a person's health condition can be analyzed. Iris eye that is damaged (abnormal) there are patches of pigment.



(a) (b)

Fig. 2:Normal Iris (a), Abnormal Iris (b)

4.1 Image Processing

Image processing is used to get the location of the iris area that shows a decline in organ function in accordance with the data sought. Image processing is designed using the median filter method, hough circle transformation and region of interest (ROI).

(i) Median Filter

The initial iris image is made into a grayscale image, then read the value at each pixel of the grayscale image value. The calculation is done by sorting the pixel intensity value group and then changing the pixel value processed by the average value of the sequence results. The filter used is 5x5 in size.

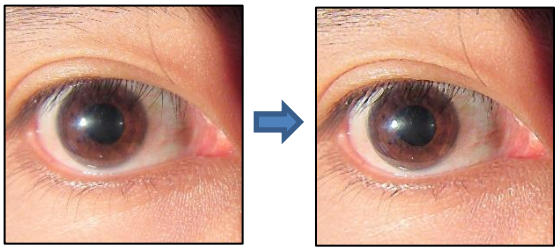


Fig. 3: Median Filter of Iris Image

(ii) Hough Circle Transform

The image of the median filter results will be detected edges then transformed to the accumulator (a b space) using $a = x - \theta\cos\theta$ and b = y− R $\sin\theta$. Variables a and b = circle points on the accumulator, x and y = coordinates of the points in the transformed image θ = angle from 0o to 360°. The results of this transformation will produce a new circle on the accumulator. Some of the circles on the accumulator will intersect at a certain point. Then vote and cell that has the largest value will be detected as the actual center of the circle. Hough circle transform process to get the perfect iris.

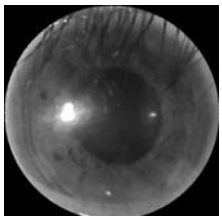
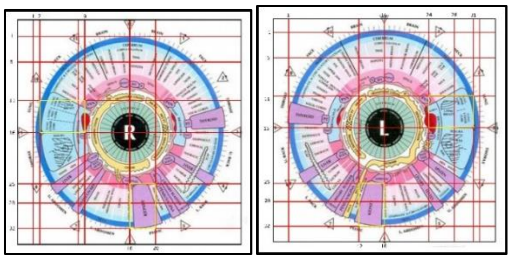


Fig. 4: Hough Circle Transform of Iris Image

(iii) Region of Interest (ROI)

ROI is used to find points in the kidney or lung area to be detected. The strategy of taking the area of the lungs or kidneys, the iris image will be divided into 32 parts as shown in figure a for right eye iris ROI and image b for left eye iris ROI



(a) Right Eye (b) Left Eye

Fig. 5: Hough Circle Transform of Iris Image

The results of image processing are used as training and test data. Example of iris image resulting from image processing:

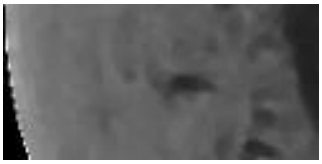


Fig. 6: Result of Image Processing

4.2 Model Making

Following are the steps in making an iridology model:

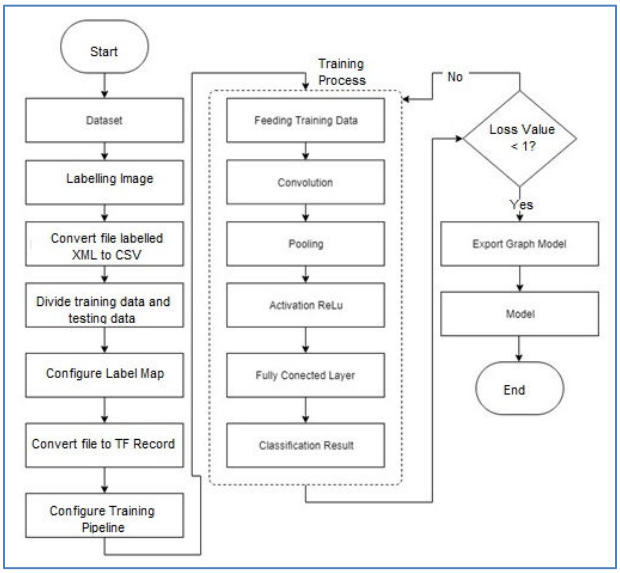


Fig. 7: Iridology Model Making

In this study, a single shot detector (SSD) with a convolutional neural network architecture is used which is VGG16. SSD models using MobileNet can run with light computing [11]. In this study, the SSD model using MobileNet underwent a modification in the clarification process to get the appropriate output.

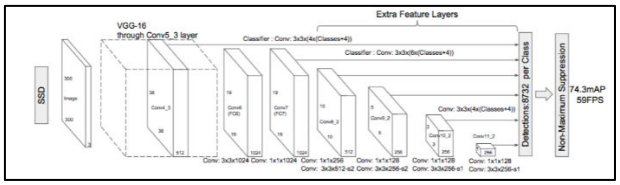


Fig. 8: VGG16 Architecture

This architecture has 13 convolution layers and five max-pooling layers. All convolution layers have a filter width of 3 x 3 with the number increasing in each block. All of these layers have the ReLU activation function. While the max-pooling layer has a filter width of 2 x 2. There is also a global average pooling layer before entering the two fully connected layers. Both fully connected layers have 512 hidden units and a dropout of 0.5. The output from this set of processes will be classified with the classifier. The classifier used is a fully connected layer with a softmax activation function. This layer is needed so that the training process with backpropagation can be carried out.

4.3 Model Testing

Following are the steps in making an iridology model testing:

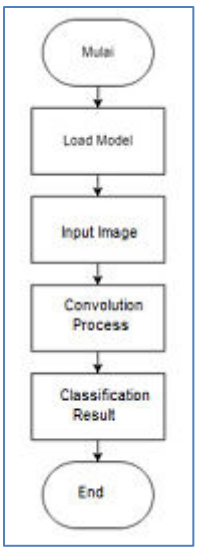


Fig. 9: Flowchart of Model Testing

Accuracy is one of the parameters in this study. Accuracy is obtained after the model testing process in the form of a percentage. Accuracy calculations are performed on each part of the iris of the left or right eye which has decreased organ function in the lungs or kidneys. Calculation formula:

$$Percentage\ of\ Accuracy = \frac{Amount\ of\ test\ data\ image\ is\ correct}{Total\ amount\ of\ test\ image\ data}$$

From the above calculation, it can be seen the level of accuracy of the Convolutional Neural Network method in identifying decreased organ function in the lungs or kidneys through the iris of the eye.

The training process starts by calling the training library from TensorFlow. The data training process with steps totaling 50,000 requires approximately 2 days. The output that will be generated during the training process data will be included in the training folder. The loss value is a quantitative measure of how much the predictions differ from the actual output (label). The value of the loss is inversely proportional to the accuracy of the model. The greater the loss value, the less accurate the model is made. The loss value in this training process is following the research target of 0.8504. The iridology model created was tested with input data in the form of 10 right eye iris data and 10 left eye iris data. One iris image has 2 tests to identify decreased lung and kidney function according to ROI. Model testing is made in the form of a desktop application. The following are examples of test results:

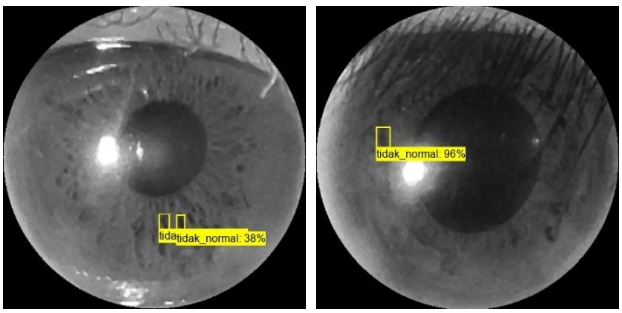


Fig. 10: Right Eye Testing

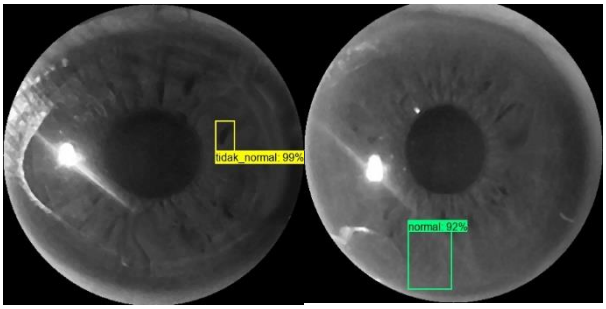


Fig. 11: ***Left*** **Eye Testing**

From the result of these tests, the calculation of accuracy:

$$\frac{36}{40}\ x\ 100\% = 90\%$$

Accuracy obtained by 90%, with details of 10 data decline in function of the right iris kidney organ is true, 9 data decline in function of the right iris pulmonary organ is true, 8 data decline in kidney function of the left iris is true and 9 data decline in organ function left iris lung is true. Incorrect data are 1 data decline in function of the right iris pulmonary organ, 2 data decrease in function of the left iris kidney organ and 1 data decrease in function of the left iris lung organ. Incorrect data is not detected because noise and light in shooting make parts undetectable

5. Conclusion

Convolutional Neural Network using VGG16 architecture can recognize well the pattern of decreased organ function excretion through the iris with an accuracy of 90% from 40 testing data. Future studies can develop by examining the noise and light factors in the iris in the iris image processing

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