



# ICOSTA

**2020 International Conference on Smart  
Technology and Applications (ICoSTA)**

*Empowering Industrial IoT by  
Implementing Green Technology  
for Sustainable Development*

**IEEE Part Number : CFP20OSW-ART**

**ISBN : 978-1-7281-3083-5**

**20 February 2020**

**Mercure Hotel Surabaya**  
JI Raya Darmo 68 - 78 60264 SURABAYA

# **2020 International Conference on Smart Technology and Applications (ICoSTA)**

## **Proceeding**

2020 International Conference on Smart Technology and Applications (ICoSTA) took place 20 February 2020 in Surabaya, Indonesia.

IEEE catalog number : CFP20OSW-ART

ISBN : 978-1-7281-3083-5

Copyright and Reprint Permission: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923. For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854.

All rights reserved. Copyright © 2020 by IEEE.

# Organizing Committee

## General Chair

Dr. Rr. Ani Dijah Rahajoe, S.T., M.Cs (Universitas Bhayangkara Surabaya, Indonesia)

## General Co-Chair

Rifki Fahrial Zainal, S.T., M.Kom (Universitas Bhayangkara Surabaya, Indonesia)

## Technical Program Committee Chair

Dr. Ir. Saidah, M.T (Universitas Bhayangkara Surabaya, Indonesia)

## Technical Program Committee Co-Chair

Dr. Bambang Purwahyudi S.T., M.T (Universitas Bhayangkara Surabaya, Indonesia)

## Advisory Board

Prof. Wu Xi Ph.D (Chengdu University of Information Technology, China)

Prof. Lin Peng Ph.D (Shantou University, China)

Prof. Dr. D. K. Lobiyal (Jawaharlal Nehru University, India)

Prof. Dr. Taufik (California Polytechnic State University, USA)

Prof. Sun Xingyang (Yangzhou Polytechnic Institute, China)

Prof. Dr. Ir Jazi Eko Istiyanto, M.Sc., IPU, ASEAN Eng (Universitas Gadjah Mada, Indonesia)

Prof. Dra. Sri Hartati, M.Sc., P.hD (Universitas Gadjah Mada, Indonesia)

Prof. Dr. Ir. Mochamad Ashari, M.Eng. (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Dr. Ir. Mauridhi Hery Purnomo, M.Eng. (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Ir. H. Ontoseno Penangsang, M.Sc, Ph.D (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Dr. Ir. Adi Supriyanto MT (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Dr. Ir. Achmad Jazidie, M.Eng (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Dr. Yoyon K. Suprpto (Institut Teknologi Sepuluh Nopember, Indonesia)

Prof. Dr. Gamantyo Hendratoro (Institut Teknologi Sepuluh Nopember, Indonesia)  
Prof. Dr. Ir. Mohammad Nuh, DEA (Institut Teknologi Sepuluh Nopember, Indonesia)  
Prof. Dr. Anton Satri Prabuwono (King Abdul Aziz University, Saudi Arabia)  
Prof. Dr. Eng. Safarudin (Universitas Hasanuddin, Indonesia)  
Prof. Ir. Rukmini Sari Hartati MT., Ph.D (Universitas Udayana, Indonesia)  
Prof. Dr. Bambang Riyanto (Institut Teknologi Bandung, Indonesia)  
Prof. Dr. Iwa Garniwa (Universitas Indonesia, Indonesia)  
Prof. Arif Junaidi (Institut Teknologi Sepuluh Nopember, Indonesia)  
Prof. Ida Ayu Giriantari (Universitas Udayana, Indonesia)  
Prof. Joko Lianto Buliali Ph.D. (Institut Teknologi Sepuluh Nopember, Indonesia)

### **Technical Program Committee**

Dr. Adhi Dharma Wibawa (Institut Teknologi Sepuluh Nopember, Indonesia)  
Dr. Ir. Dian Retnosavitri (Universitas Dian Nuswantoro, Indonesia)  
Dr. Ir. Mohamad Haddin (Universitas Islam Sultan Agung, Indonesia)  
Dr. Yusron (Universitas Hasanuddin, Indonesia)  
Dr. Muhammad Rivai (Institut Teknologi Sepuluh Nopember, Indonesia)  
Dr. Ing. MHD. Reza M.I. Pulungan, S.Si.,M.Sc (Universitas Gadjah Mada, Indonesia)  
Afiahayati,S.Kom.,M.Cs.,Ph.D (Universitas Gadjah Mada, Indonesia)  
Dr. Ahmad Ashari,M.Kom (Universitas Gadjah Mada, Indonesia)  
Dr. Drs. Azhari, MT (Universitas Gadjah Mada, Indonesia)  
Drs. Agus Harjoko,M.SC.,Ph.D (Universitas Gadjah Mada, Indonesia)  
Dr. Suprpto,M.Kom (Universitas Gadjah Mada, Indonesia)  
Drs. Edi Winarko,M.Sc.,Ph.D (Universitas Gadjah Mada, Indonesia)  
Dr. Yohanes Suyanto,M.I.Kom (Universitas Gadjah Mada, Indonesia)  
Dr. Agfianto Eko Putra, M.Si (Universitas Gadjah Mada, Indonesia)  
Dr. tech Khabib Mustofa, S.Si., M.Kom (Universitas Gadjah Mada, Indonesia)  
Anny Kartika Sari,S.Si., M.Sc., Ph.D (Universitas Gadjah Mada, Indonesia)  
Wahyono, S.Kom., Ph.D (Universitas Gadjah Mada, Indonesia)  
Drs. Retantyo Wardoyo,M.Sc., Ph.D (Universitas Gadjah Mada, Indonesia)

# Table of Contents

<b>Title</b>	i
<b>Copyright</b>	ii
<b>Message From The General Chair</b>	iii
<b>Speech From The Rector of University of Bhayangkara Surabaya</b>	iv
<b>Organizing Committee</b>	v
<b>Parallel Class Schedule</b>	vi
<b>Table of Contents</b>	xxi
<b>Papers</b>	
<b>Parallel Class 1</b>	
Improved K-Means Algorithm on Home Industry Data Clustering in the Province of Bangka Belitung	1
Classification of Student Academic Performance using Fuzzy Soft Set	7
Segmentation of Customer Experience of YouTube Streaming Application Users in South Jakarta using K-means Method	13
Comparison of Distance Function to Performance of K-Medoids Algorithm for Clustering	18
A Survey on Multimodal Information Retrieval Approach	24
Improvement of Data Accuracy on Backpropagation Neural Network-based Automatic Control System for Wheeled Robot	30
A Review of Iris Recognition System ROI and Accuracy	35
A Survey on Visualization Techniques to Narrate Interpersonal Interactions between Sportsmen	41
Comparison of SVM and BPNN Methods in The Classification of Batik Patterns Based on Color Histogram And Invariant Moments	47
<b>Parallel Class 2</b>	
Performance comparison of wireless protocol IEEE 802.11ax vs IEEE 802.11ac	51
Improving Intrusion Detection System by Estimating Parameters of Random Forest in Boruta	56
Pearson Correlation Attribute Evaluation-based Feature Selection for Intrusion Detection System	62
Port Session Communication Analysis Using Density-Based Clustering For Host Anomaly and Risk Activity Analysis	67

The QoS Improvement Using CDN for Live Video Streaming with HLS	73
Detecting Features of Middle Size Soccer Field using Omnidirectional Camera for Robot Soccer ERSOW	78
Performance Analysis of Self-Organizing Map Method for Wheeled Robot Control System	84
Development of Localization Technique using Trilateration Algorithm for E-Puck2 Robot	89
Integration of N-GCPSO Algorithm with Spatial Particle Extension Algorithm for Multi-Robot Search	95
Design of Restaurant Billing System (E Bill Resto) by Applying Synchronization of Data Billing in Branch Companies to Main Companies Based on Rest API	99
<b>Paralell Class 3</b>	
Automatic Sign of Commencement of Work from Enterprise Resource Planning	104
Improve Smart Waste Management to Preserve Tourist Attractions Yogyakarta in IoT Environment	110
Industry 4.0 strategic alignment framework: Multilevel perspective of digital transition in Indonesia	116
Design of Soil Humidity Monitoring System Using the Internet of Things Concept and MQTT Protocol	122
A Change Management Model for Information Systems Implementation	128
Android Application for Advanced Security System based on Voice Recognition, Biometric Authentication, and Internet of Things	134
The Combination of Analytical Hierarchy Process and Simple Multi-Attribute Rating Technique for The Selection of The Best Lecturer	140
Development of Automatic Plant Irrigation System using Soil Moisture Sensors for Precision Agriculture of Chili	145
Feature Selection Based on Modified Harmony Search Algorithm	149
<b>Parallel Class 4</b>	
Design and Implementation of an Emergency Datacasting System Using 2-meter Amateur Radio Band	156
Design of Wireless Electromyography (EMG) Monitoring System for Muscle Activity Detection on Parkinson Disease	161
Characterization of Magnetic Induction Coil Sensor for Void Detection in Steel Plate	165
Multiband Microstrip Antenna Design for Radio Frequency Identification (RFID) Application	170

Theta, Alpha and Beta Activity in the Occipital Based on EEG Signals for Mental Fatigue in High School Students	175
The Effect of Harmonics on Purification Scheduling of Transformer Oil Insulation to Restrain The Degradation Rate	182
An HF Digital Communication System Based on Software-Defined Radio	186
Capacity Analysis for Hybrid Beamforming MIMO Channel using Discrete Cosine Transform and Antenna Selection	191
Solar Energy Monitoring System Design Using Radio Frequency For Remote Areas	195
<b>Parallel Class 5</b>	
Analysis of Short Circuit on Four Types Wind Power Plants as Distributed Generation	201
Power Quality Enhancement on Hybrid Power Plants Using Shunt Passive Power Filter and Detuned Reactor	206
Load Factor Improvement on Daily Load Curve Using Pump Storage to Saving Production Cost	212
Analysis of Power Transactions on the Integrated Solar Home System	218
Analysis and Design Implementation of Modulator $\pi/4$ - Differential Quadrature Phase Shift Keying Low Power Based on FPGA	223
Fault Tolerant Control for Speed Sensorless of DC Motor	229
Power Transfer Analysis Using UPQC-PV System Under Sag and Interruption With Variable Irradiance	234
Fault-Tolerant Control Strategy Based on Reliability and Cost Analysis in Heat Recovery Steam Generator Plant	241
Design Of One Phase Inverter 250 Watt Third Harmonic Pulse Width Modulation Method In Mini-Grid Photovoltaic	247
<b>Parallel Class 6</b>	
Data Quality Measures and Data Cleaning for Pattern Analysis Angkot Transportation in Bandung City	253
Design and Implementation of IoT-Based Smart Home Voice Commands for disabled people using Google Assistant	260
Smart Greetthings: Smart Greenhouse Based on Internet of Things for Environmental Engineering	266
Decentralized Tourism Destinations Rating System Using 6AsTD Framework and Blockchain	271
A Fuzzy Servqual Method for Evaluated Umrah Service Quality	277

Analysis the Issue of Increasing National Health Insurance (BPJS Kesehatan) Rates through Community Perspectives on Social Media: A Case Study of Drone Emprit	283
Analysis of Malang City Readiness in Realizing Smart Tourism with New Integrated E-Readiness Model	290
IoT Based: Improving Control System For High-Quality Beef in Supermarkets	296
Design of Portable Galvanic Skin Response Sensor for Pain Sensor	301
<b>Parallel Class 7</b>	
Prediction of Bitcoin Price Change using Neural Networks	306
Generalized Regression Neural Network For Long-Term Electricity Load Forecasting	310
Resource Optimization in Heterogeneous Networks Using Discrete Firefly Algorithm	315
A Review on Question Analysis, Document Retrieval and Answer Extraction Method in Question Answering System	320
Design of Control Algorithm for Monitoring System and Bridge Control Based on Internet of Things (IoT)	325
Optimization of DG Placement and size using PSO based on GUI	331
Natural Tele-manipulation for Robot Movement based on Motion Pattern of Arm Posture	337
Fault Classification of Induction Motor Using Discrete Wavelet Transform and Fuzzy Inference System	341
Faults Identification of Induction Motor Based on Vibration Using Backpropagation Neural Network	347
<b>Acknowledgement to Reviewers</b>	352
<b>Authors Index</b>	353



# A Review of Iris Recognition System ROI and Accuracy

Robby Alphonsus Halim  
Magister Informatik  
Universitas Atma Jaya Yogyakarta  
Yogyakarta, Indonesia  
robby7370@gmail.com

Andi Wahyu Rahardjo Emanuel  
Magister Informatik  
Universitas Atma Jaya Yogyakarta  
Yogyakarta, Indonesia  
andi.emmanuel@uajy.ac.id

**Abstract**— Iris contains some information about human body and organ condition. Iridology is a scientific study of the iris structure to get some information that represents the condition of the various organs by examining the tissue strengths and weaknesses in the iris. With the rapid development of image processing, iridology has become more popular and reliable. In recent years, many systems that adopt iridology have been developed to diagnose a disease by analyzing a certain part of the iris or so-called Region of Interest (ROI). Typically, iris recognition systems consist of three main functions namely image pre-processing, feature extraction, and classification. This paper shows all the regions that have been studied and the accuracy of their iris recognition system.

**Keywords**— Iridology, Iris Recognition System, ROI, System accuracy.

## I. INTRODUCTION

The human iris is a ring-shaped part between cornea and pupil (Figure 1). Even though iris is considered as human inner organ, iris can be observed with ease from the exterior [1]. Iris is a screen where nerve systems are located and contain pieces of information about the human body [2]. The scientific study to analyze this information and specify weaknesses in the human body is called iridology. Iridologists examine the iris fiber, color, brightness, and shadings by looking at the iris and claim that iridology can predict the risk of disease because signs that represent body debility will appear in iris earlier than the organ itself. [3].

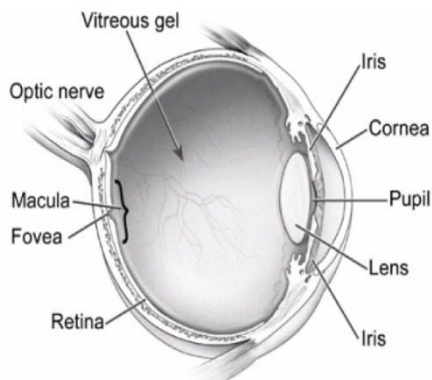


Figure 1. Human iris [1].

In iridology, there is a chart that can be used to find the organ that the iris represents namely the iridology chart (Fig. 2). The iridology chart shows the left side and the right side

of an iris image with highlighted regions for each organ. This chart used by iridologists to compare the signs such as a circular iris fiber, circular ring, dark spot, etc, of the patient iris with the healthy iris. Based on the observation, they will specify which part of the body is weak or susceptible to suffer from diseases sooner than actual symptoms[4]. Typically, iridology charts divide an iris image into 80 to 90 regions [3].

The iris recognition system usually only analyze one region of the iris. Every iris recognition system consists of three main functions. The three main functions of this system are image pre-processing, feature extraction and classification. The image pre-processing function is used to obtain the ROI of the iris from the iris image. Generally, pre-processing is consists of five steps: transform into a greyscale image, iris localization, normalization, histogram equalization, and separating the ROI. The feature extraction function used to extract features from the cropped ROI image using one or more texture analysis methods. The extracted features are used for classification purposes. The classification function is an algorithm to predict and make a decision either the testing data is suffered from the disease or not.

The rest of this paper is structured as follows: Section 2 provides an overview of image pre-processing. Section 3 explains an overview of feature extraction. Section 4 provides an overview of classification. Section 5 serves the graph that shows all the regions that have been studied, the feature extraction used, the classification used, and the accuracy of their iris recognition system since 2017 and the conclusion of the paper in section 6.

## II. IMAGE PRE-PROCESSING

The image preprocessing function is used to obtain the ROI of the iris from the iris image. Generally, preprocessing is consists of five steps:

### A. Transform Into A Grayscale Image

The purpose of converting the image into gray level image is to enable the process to localization the iris or separating it from the sclera and the pupil and then normalize the iris and matched it with the iridology charts [5]. Generally, this formula can convert color image to grayscale image: [6]:

$$I = a \times R + b \times G + c \times B, a + b + c = 1 \quad (1)$$

$$I = 0,2989 \times R + 0,5870 \times G + 0,1141 \times B \quad (2)$$

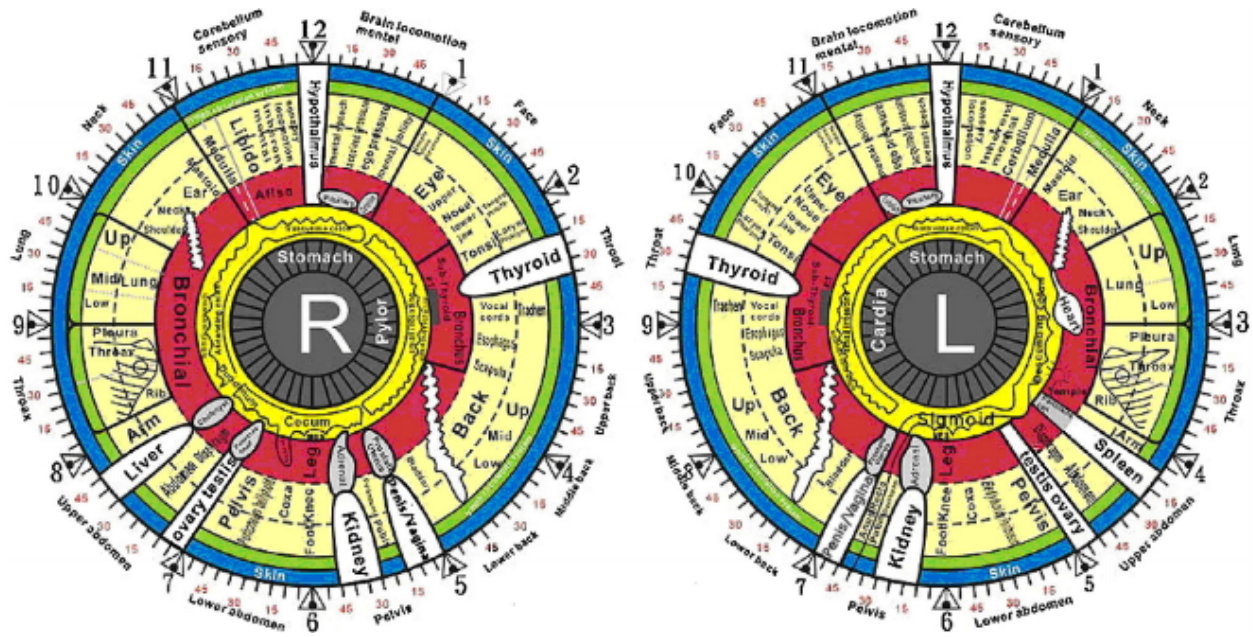


Figure 2. Iridology chart [5].

### B. Iris Localization

The purpose of iris localization is to locate the outer boundaries and inner boundaries of the iris [5]. The difference of intensity between sclera, iris, and pupil can be used to locate the outer and inner boundaries. Hough Transform (CHT) is a technique that usually used for iris localization. CHT is a computer vision algorithm to determine parameters from geometric objects, such as circles and lines, in the image. The CHT technique is used to deduce the center coordinates of the pupil, the radius of the pupil, and iris regions [7].

In this transform, firstly, the first derivative of the intensity from an eye image is calculated. After that, thresholding the first derivatives result and generating the edge map. Afterward, parameters of the circle were calculated as the circle passing through each maximum edge point in the edge map. The main parameters of this algorithm are the radius and center coordinates of iris and pupil [8]. Figure 3 illustrates the process of iris localization.

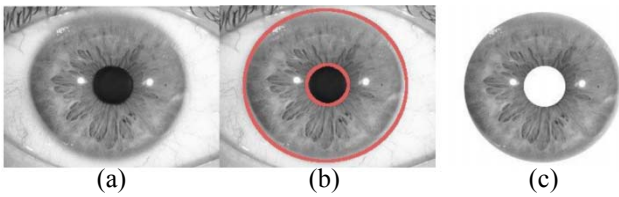


Figure 3. Iris localization stages. (a) An eye image (grayscale). (b) Two circles for pupil and iris boundaries. (c) Result of segmented iris [5].

### C. Normalization

After localizing the iris, the image will be transformed into a rectangle form from a ring form to make it easier for analysis the image. This step is called normalization [9]. The technique that usually used to normalized the image is the rubber-sheet model. This technique remaps the iris localization image into a rectangle where one axis represents the radial angle and the other one represents the

radius. Figure 4 shows the result of iris normalization. This remapping can be modeled as follows [8] and the results can be seen in figure 4:

$$I(x(r, \theta), y(r, \theta)) \rightarrow I(r, \theta) \quad (3)$$

With

$$x(r, \theta) = (1 - r)x_p(\theta) + rx_i(\theta) \quad (4)$$

$$y(r, \theta) = (1 - r)y_p(\theta) + ry_i(\theta) \quad (5)$$

Where:

$I(x, y)$  = Iris region

$(x, y)$  = Original coordinates

$(r, \theta)$  = Corresponding polar coordinates

$(x_p, y_p)$  and  $(x_i, y_i)$  = Inner and outer boundaries coordinates along with  $\theta$  direction

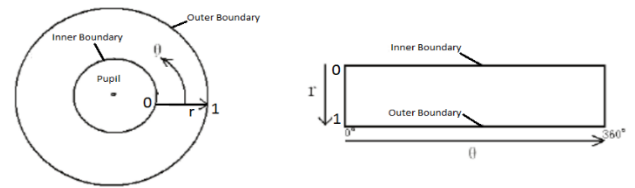


Figure 4. Iris normalization.

### D. Histogram Equalization

Histogram Equalization is an image processing technique for improving image contrast. This technique is spreading out the intensity values that appear the most and the intensity range of an image. Histogram equalization can be performed by calculating probability and cumulative density function, calculating the number of pixels for every color, producing the total of the count, and then scaling the results. This technique is used when the usable data have close values of contrast. Therefore, this technique is suitable for iris image because the image pixels generally occupy the entire range of gray levels (0 to 255). In addition, the image has a high contrast appearance and has a large variety of gray tones [10]. Figure 5 shows the result of histogram equalization.

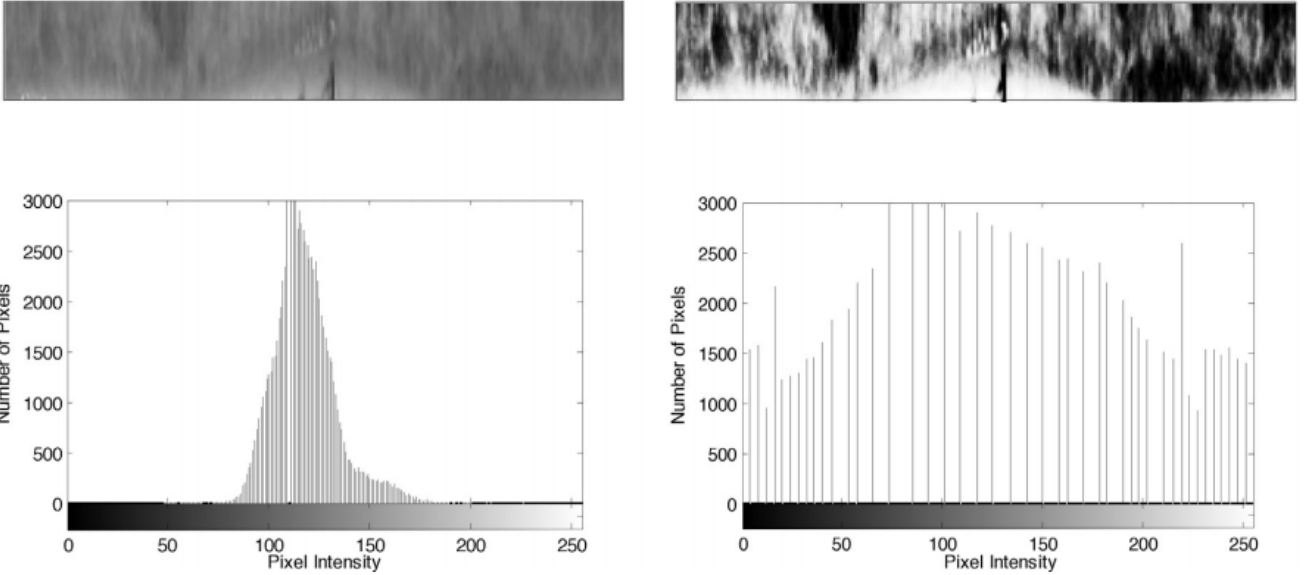


Figure 5. Histogram Equalization of an iris normalization image. Left, iris normalization image and its histogram before histogram equalization. Right, iris normalization image and its histogram after histogram equalization [5].

### E. Separating the ROI

ROI is a particular part of a dataset or an image that will be identified or operate or filter for a specific purpose. In iridology, the ROI is a particular part of an iris image that represents a particular part or organ of a human body. This region will be analyzed to determine the health condition of that organ. [4].

## III. FEATURE EXTRACTION

The feature extraction function used to extract features from the cropped ROI image using one or more texture analysis methods. The extracted features are used for classification purposes. Each researchers employed various algorithm to extract features [11]. There are some common methods to extract features:

### A. Black White Ratio

Black White Ratio is a feature extraction method that calculates the white and black pixels from a binary image and divides the total number of white pixels and black pixels with the total pixels of the image. Following is the formula to calculate the ratio [12]:

$$\text{White Ratio} = \frac{\text{Total of White Pixels}}{\text{Total Pixels}} \quad (6)$$

$$\text{Black Ratio} = \frac{\text{Total of Black Pixels}}{\text{Total Pixels}} \quad (7)$$

The average accuracy of this method regardless of the type of classifier is 81.91%, with the highest accuracy of 92%. Most studies using this extraction feature use thresholding algorithms as classifiers and also apply the auto-cropping function to their systems.

### B. Gray Level Co-Occurrence Matrix (GLCM)

Gray Level Co-Occurrence Matrix (GLCM) is a feature extraction to obtain the gray level from an eye image [13]. The grayish value of an eye image is different from each other. Following is the steps to use GLCM feature extraction:

- 1) Initialize the matrix area.
- 2) Set the spatial relation of the neighbor and the reference pixel, and set the distance  $d$  and the angle  $\theta$ .
- 3) Calculating the concurrency matrix with the transposes concurrency matrix to make it symmetric.
- 4) Transform the matrix to probability form ( $Pd$ ) by normalizing it.

The following is the statistics characteristics of Gray Level Co-Occurrence Matrix (GLCM): 1) Energy, 2) Homogeneity, 3) Contrast, and 4) Entropy [14]. The average accuracy of this method regardless of the type of classifier is 87.31%, with the highest accuracy of 97.78%.

### C. 2D Gabor Filter

The 2D Gabor filter is a feature extraction that has a good ability to distinguish space dan frequency domain. The Daughman's iris recognition often uses this feature extraction [11] [15]. The average accuracy of this method regardless of the type of classifier is 88.6%, with the highest accuracy of 91.8%.

## IV. CLASSIFICATION

The classification function is an algorithm to predict and make a decision either the testing data is suffered from the disease or not. There are some common method for classification:

### A. Thresholding Algorithm

The thresholding algorithm is a classifier that classified the ratio in the image. This classifier usually used for black and white ratio feature extraction. The thresholding algorithm steps are as follow [16]:

- 1) Set the limit or threshold.
- 2) Determine the class label. The label will be used to classify the data whether it is less or over the threshold. In the research about iridology, the labels usually are named abnormal and normal.

3) *Input the data (segmented eye image) that will be classified.*

4) *Classify and labeling the data based on the value of the data, whether it is less or over the threshold that was set in the first step.*

The average accuracy of this classifier regardless of the type of classifier is 81.91%, with the highest accuracy of 92%.

### B. Backpropagation Neural Network.

The backpropagation neural network is an artificial neural network that has learning techniques. The backpropagation neural network is a method for solving a problem by feeding a set of data as the learning or training process [17]. This method widely used because of its ability to minimize the error of the output [14]. The average accuracy of this classifier regardless of the type of classifier is 82.5%, with the highest accuracy of 83.33%.

### C. Support Vector Machine (SVM)

Support Vector Machine (SVM) is a binary classifier that uses the structural risk minimization principle. Vapnik was the proposer of this method [18]. Currently, the S method is often used for various fields such as image recognition, pattern recognition, text classification, etc [19]. Paper Cristianini [20] and Burges [21] provide more in-depth information about Support Vector Machine. The average accuracy of this classifier regardless of the type of classifier is 93.33%, with the highest accuracy of 96%.

## V. IRIS RECOGNITION SYSTEM ROI AND ACCURACY

Figure 6 shows all the regions that have been studied and the accuracy of their iris recognition system since 2017. All paper that we used to make this survey are all journals and conferences which are show in the list of google scholar with the keyword of ““iridology” and “image processing.”” And also we only use English and Indonesian paper. The total of the paper used to make figure 6 is 26 paper. Table 1 shows detailed data from the paper used to make the figure 6.

The most frequently studied ROI is Arcus Senilis and Pancreas with a total of 7 papers since 2017. The highest accuracy is found in paper Ridza [23] with an accuracy value of 97.78% using Gray Level Co-Occurrence Matrix (GLCM) as the feature extraction and Bayesian regularization (BR) classifier as the classifier.

## VI. CONCLUSION

As we can see in figure 6, most popular ROI that have been researched is Arcus Senilis and Pancreas, with the highest accuracy of 97.78% for ROI of Arcus Senilis and 95.81% for ROI of Pancreas. The iris recognition system with the highest accuracy is in paper Ridza [23]. In this paper, they use Gray Level Co-Occurrence Matrix (GLCM) feature extraction and Bayesian regularization (BR) classification to diagnose either the subject is suffering from the disease or not.

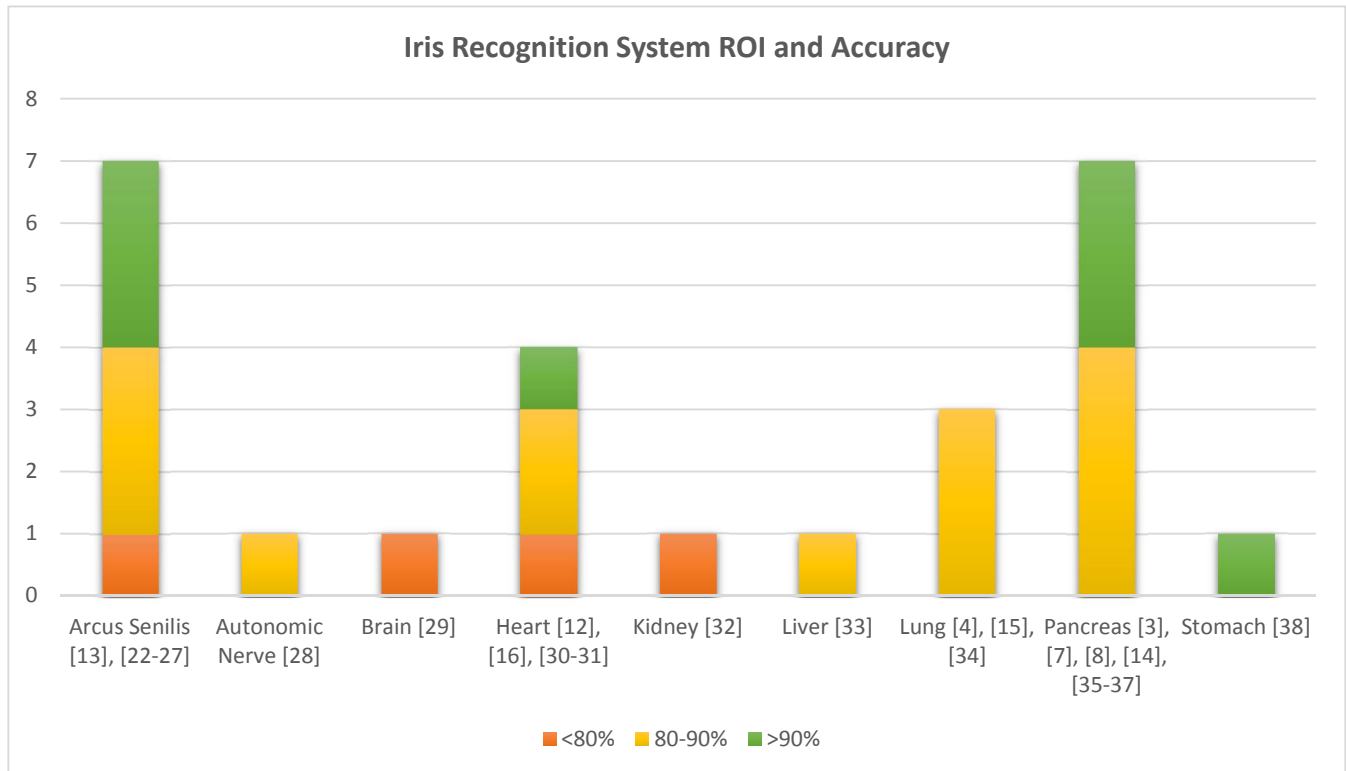


Figure 6. Graph of all paper ROI and accuracy results about iridology and image processing.



TABLE I. DETAILED DATA OF THE 26 REVIEWED PAPERS.

ROI	Feature Extraction	Classifier	Accuracy
Arcus Senilis	Gray Level Co-Occurrence Matrix (GLCM)	Backpropagation Neural Network	81.81% [13]
	Gabor Filter	Otsu Threshold	86.00% [22]
	Grey Level Co-occurrence Matrix (GLCM)	Bayesian Regularization (BR) Classifier	97.78% [23]
	Fuzzy Local Binary Pattern (FLBP)	Linear Regression Analysis	91.40% [24]
	-	RBF	89.00% [25]
	-	RBF	53.33% [26]
	Histogram Of Oriented Gradients (HOG)	Artificial Neural Network (ANN)	93.00% [27]
Autonomic Nerve	Principal Component Analysis (PCA)	Backpropagation Neural Network	83.33% [28]
Brain	Average Intensity, Average Contrast of Standard Deviation, Mildness, Third Moment, Uniformity of The Histogram, Entropy	Naïve Bayes	61.96% [29]
Heart	Black And White Ratio	Thresholding Algorithm	70.00% [12]
	Black And White Ratio	Thresholding Algorithm	83.33% [16]
	Black And White Ratio	Thresholding Algorithm	82.30% [30]
	SURF-Features	MCO-SVM (Multi-Class Oriented SVM)	96.00% [31]
Kidney	Gray Level Co-Occurrence Matrix (GLCM)	Euclidean Distance	70.00% [32]
Liver	Grey Level, Enhancing and Sobel Operator	Histogram	84.00% [33]
Lung	2D Gabor filter and 2D Discrete Wavelet Transform (DWT)	Support Vector Machine (SVM)	89.00% [4]
	2D Gabor Filter	Support Vector Machine (SVM)	88.00% [15]
	Gabor Features Based Blob Detector	Support Vector Machine (SVM)	88.00% [34]
Pancreas	Pixel Information, Gabor Filter, HOG, and LBP	Adaboost	91.80% [3]
	Discrete Wavelet Transform (DWT)	Random Forest	89.66% [7]
	Statistical, Texture And Discrete Wavelength Transformation Features	Random Forest	89.63% [8]
	Gray Level Co-Occurrence Matrix (GLCM)	Artificial Neural Network Backpropagation	82.35% [14]
	Statistical, GLCM And GLRL Features (With T-Test Feature Selection)	EBoT (Boosted Tree)	95.81% [35]
	Black And White Ratio	Thresholding Algorithm	92.00% [36]
	Statistical, Texture Analysis, And Two-Dimensional Discrete Wavelet Transformation	Random Forest	89.66% [37]
Stomach	RGB Components And The Gray-Scale Transformation	Support Vector Machine (SVM)	96.00% [38]

REFERENCES

[1] O. Zuraini, P. Anton Satria, "Preliminary Study on Iris Recognition System: Tissues of Body Organs in Iridology," in 2010 IEEE EMBS Conference on Biomedical Engineering & Sciences (IECBES 2010), 2010, pp 115-119.

[2] B. Jensen On The SCIENCE and PRACTICE of IRIDOLOGY, WHITMAN Publications, 1952.

[3] P. Moradi, N. Nazer, A. K. Ahmadi, H. Mohammadzade and H. K. Jafari, "Discovering Informative Regions in Iris Images to Predict Diabetes," in 2018 25th national and 3rd International Iranian Conference on Biomedical Engineering (ICBME), IEEE, 2018.

[4] B. Atul, A. Ravinder, K. Sharma R., "Iris images based pre-diagnostic tool to predict obstructive lung diseases", Biomedical Research 2018; Special Issue: S517-S522.

[5] H. Sherif E., H. Osama A., G. Malcolm H., "Assessment of the potential iridology for diagnosing kidney disease using wavelet analysis and neural networks", Biomedical Signal Processing and Control 8, 2013, pp 534-541.

[6] R. Nova Ayu, Arini, S. Anif Hanifah, "Colon Detection Using Principal Component Analysis (PCA) and Support Vector Machine (SVM)," in 2016 4th International Conference on Cyber and IT Service Management, IEEE, 2016.

[7] S. Piyush, A. Ravinder, "Comparative analysis of classification based algorithms for diabetes diagnosis using iris images," Journal of Medical Engineering & Technology, 2018 Jan, Vol. 42, No. 1, pp 35-42.

[8] S. Piyush, A. Ravinder, "Machine learning techniques for medical diagnosis of diabetes using iris images," Computer Methods and Programs in Biomedicine, Volume 157, April 2018, pp 121-128.

[9] A. Asuntha, Y. Sree Charan, M. Siddhartha, K. Udhaykumar, and S. Andy, "Identification of Diabetics Mellitus using Iridology," International Journal of Research in Pharmaceutical Sciences, vol. 10, no. 3, 2019, pp. 1821-1823.

[10] H. R. G. Alam Nusantara Putra, I. R. Rizal, Z. Ajub Ajulian, "Application of Liver Disease Detection Using Iridology with Back-Propagation Neural Network," Proc. of 2015 2nd Int. Conference on Information Technology, Computer and Electrical Engineering (ICITACEE), Indonesia, Oct 16-18th, pp 123-127.

[11] L. Ma, N. Li, "Texture feature extraction and classification for iris diagnosis," International conference on medical biometrics. Lect Notes Comp Sci Springer-Verlag 2007, pp 168-175.

[12] E. M. Kusumaningtyas, A. R. Barakbah, A. A. Hermawan and S. R. Candra, "Auto cropping for application of heart abnormalities detection through Iris based on mobile devices," 2017 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC), Surabaya, 2017, pp. 108-113.

[13] S. Agung, B. Wisnu, and R. Liani Budi, "Deteksi Kadar Kolesterol Melalui Iris Mata Menggunakan Image Processing Dengan Metode Jaringan Syaraf Tiruan Dan Gray Level Co-Occurrence Matrix (GLCM)," Prosiding Seminar Nasional Fisika (E-Journal) SNF2017, vol. 6, 2017.

[14] D. C. Adelina, R. Sigit, T. Harsono and M. Rochmad, "Identification of diabetes in pancreatic organs using iridology," 2017 International

Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC), Surabaya, 2017, pp. 114-119.

- [15] B. Atul, A. Ravinder, K. Sharma R., "Pre-Diagnostic Tool to Predict Obstructive Lung Diseases Using Iris Recognition System," In: Smart Innovations in Communication and Computational Sciences. Advances in Intelligent Systems and Computing, vol. 669, pp. 71-79, 2019.
- [16] F. D. Kusuma, E. M. Kusumaningtyas, A. R. Barakbah, and A. A. Hermawan, "Heart Abnormalities Detection Through Iris Based on Mobile," 2018 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC), Bali, Indonesia, 2018, pp. 152-157.
- [17] A. Hermawan, "Jaringan Saraf Tiruan Teori dan Aplikasi." ANDI, Yogyakarta, p. 208, 2006.
- [18] C. Cortes, V. Vapnik on Support vector networks-Machine Learning, Kluwer Academic Publishers, Boston. 1995; pp. 273-297.
- [19] K. Kyung-Ah, C. Joon Yul, Y. Tae, K. Sung, C. Kilsoo, and K. Deok Won, "Mortality prediction of rats in acute hemorrhagic shock using machine-learning techniques," Medical Biological Engineering and Computing, vol. 51, no: 9, 2013, pp. 1059-1067.
- [20] N. Cristianini, D. Shawe T, "An introduction to support vector machines and other kernel-based learning methods," Cambridge University press, Cambridge.
- [21] C. Burges CJ on A Tutorial on Support Vector Machines for Pattern Recognition, Kluwer Academic Publishers, Boston, 1998.
- [22] S. Louis, N. Indri, L. Rina, Z. Situlus, and Z. Mariana., "The Expert System of Cholesterol Detection Based on Iris Using the Gabor Filter." Sinkron, vol. 4, no. 1, 2019, pp. 13-18.
- [23] R. Ridza Azri, R. Abd Rahman, H. Marsyita, N. Zarina Mohd, and K. Asem, "Classification of Eye Abnormality Using Statistical Parameters in Texture Features of Corneal Arcus Image," Advanced Science Letters, vol. 24, no. 6, 2018, pp. 4063-4069.
- [24] S. N. Andana, L. Novamizanti and I. N. Apraz Ramatryana, "Measurement of Cholesterol Conditions of Eye Image using Fuzzy Local Binary Pattern (FLBP) and Linear Regression," 2019.
- [25] A. Anjarsari, D. Auli, P. Asri, and E. Winarko, "Hybrid radial basis function with firefly algorithm and simulated annealing for detection of high cholesterol through iris images," in 9th Annual Basic Science International Conference 2019 (BaSIC 2019), IOP Conf. Series: Materials Science and Engineering, vol. 546, 2019.
- [26] Y. Daniel Hadrian, W. I Made Nomo, F. Tea Qaula, "Identifikasi Pola Penyakit pada Citra Iris Mata dengan RBF Neural Network," Jurnal Informatika, vol. 5, no. 2, 2018, pp. 195-201.
- [27] S. Muhammad Arsyad, N. Ledy, R. I Nyoman Apraz, "Deteksi Level Kolesterol melalui Citra Mata Berbasis HOG dan ANN," ELKOMIKA, vol. 7, no. 2, 2019, pp. 284 - 296.
- [28] E. Wicaksono, I. Santoso, A. Zahra, and R. Isnanto, "Identifikasi Kerusakan Saraf Autonomik Melalui Citra Iris Mata Menggunakan Ekstraksi Ciri Analisis Komponen Utama (Pca) Dan Jaringan Saraf Tiruan Perambatan Balik," Jurnal Ilmiah Teknik Elektro, vol. 6, no. 3, 2017, pp. 254-258.
- [29] F. Hernandez, R. Vega, F. Tapia, D. Morocho and W. Fuertes, "Early detection of Alzheimer's using digital image processing through iridology, an alternative method," 2018 13th Iberian Conference on Information Systems and Technologies (CISTI), Caceres, 2018, pp. 1-7.
- [30] M. Entin, B. Ali, and H. Aditya, "Feature Extraction For Application of Heart Abnormalities Detection Through Iris Based on Mobile Devices." EMITTER International Journal of Engineering Technology, vol. 5, no. 2, 2018, pp. 312-327.
- [31] N. Benedictor and L. Li., "Iris features-based heart disease diagnosis by computer vision," in Ninth International Conference on Digital Image Processing (ICDIP 2017), Proc. of SPIE Vol. 10420, 2017.
- [32] A. Siska and Herman, "Peningkatan Kualitas Citra Iris Mata Menggunakan Operasi Pikel Dan Ekualisasi Histogram Untuk Pengklasifikasian Kondisi Kesehatan Ginjal," Seminar Nasional Teknologi Informasi dan Komunikasi STI&K (SeNTIK), vol. 2, 2018.
- [33] S. Maxima Ari, "Mendeteksi Kondisi Organ Liver Melalui Citra Iris Menggunakan Teknik Pengolahan Citra Digital (Detecting the Condition of Liver Organ Through Iris Image Using Digital Image Processing Techniques)." JEEE-U (Journal of Electrical and Electronic Engineering-UMSIDA), vol. 3, no. 1, pp. 138-161, 2019.
- [34] H. Tassadaq, M. Abdul, A. Muhammad, A. Taleb, and A. Eduard, "An Iris based Lungs Pre-diagnostic System," 2019 2nd International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), Sukkur, Pakistan, 2019, pp. 1-5.
- [35] P. Samant & Agarwal, "Analysis of computational techniques for diabetes diagnosis using the combination of iris-based features and physiological parameters," Neural Computing and Applications, vol. 31, issue 12, pp 8441-8453, 2019.
- [36] E. M. Kusumaningtyas, A. Barakbah and A. Salsabil, "Auto Cropping for Application of Pancreas Abnormality Detection in Order to Recognize Diabetes Mellitus Through Iris Based on Mobile Devices," 2018 International Electronics Symposium on Knowledge Creation and Intelligent Computing (IES-KCIC), Bali, Indonesia, 2018, pp. 287-291.
- [37] S. Piyush, A. Ravinder, "Diagnosis of Diabetes Using Computer Methods: Soft Computing Methods for Diabetes Detection Using Iris," World Academy of Science, Engineering and Technology International Journal of Biomedical and Biological Engineering, vol. 11, no. 2, 2017.
- [38] V. Carrera E., J. Maya, "Computer Aided Diagnosis of Gastrointestinal Diseases Based on Iridology." In: Botto-Tobar M., Pizarro G., Zúñiga-Prieto M., D'Armas M., Zúñiga Sánchez M. (eds) Technology Trends. CITT 2018. Communications in Computer and Information Science, vol. 895, pp. 531-541, 2019.