

A Novel Approach to Detect Kidney Disease through Iris

Maresh N S¹ and Prajakta Madankar²

¹⁻²The National Institute of Engineering, Department of Information Science & Engineering, Mysuru, India
Email: maheshsm764@gmail.com, prajakta@nie.ac.in

Abstract—Iridology is a scientific technique for analysing the structure of the iris. Some regions of the iris have special advantageous qualities; in addition to psychological condition, it also reserves the body's construction and specific organ conditions. The disorder is caused by the intensity organs that are stored in the iris's eyes in a structured and designed pattern. This technique could be used to develop reasonable guidelines for the detection of a variety of disorders. As a result, advanced research should be conducted on analysing iris images in order to detect organ condition. The final image is standardized by using an adaptive histogram, which first separates the image of the eye and then converts the iris image to a grey level scaled image. It is then converted into a rectangular shape, and the HMM images of eyes related to the kidneys are assembled. The final step is to diagnose the edge image of the iris HMM. Analyzing these results leads to the conclusion that the iris recognition system produces the best results.

Index Terms— Iris recognition, Hidden Markov Model (HMM), Machine Learning.

I. INTRODUCTION

Iridology is the study of iris pattern and fibre arrangement. The eye organ, more specifically the iris (also known as the eye rainbow membrane), has unique advantages in that it can store all psychological and organ conditions, including body construction. Record tracks relating to the intensity levels or irregularities of body parts affected by illness are systematically stored and patterned in the iris eyes. This must be a reasonable guide for making disease diagnoses. Diagnosis of symptoms of a disease suffered by patients is generally performed through laboratory tests, where the tests are quite expensive, sometimes cause injuries, and the results can take a long time to be known. Diagnosis of human organ disorders during its development has led to various outcomes, one of which is the use of human organs. The iris of the eye is one of the organs used to diagnose. The iris of the eye stores information about all of the human body's changes and imbalances. The project in this study is expected to categorise by utilizing detection of the edge and mining segmentation. When an image of the iris is obtained, the image of the eye must first be separated, and the iris image is then converted to a grayscale image before being standardised using an adaptive histogram. It is then converted into a rectangular shape, and the HMM (Hidden Markov Module) images of eyes related to the kidneys are assembled. The final step is to diagnose the edge image of the iris HMM. Later, it is converted to binary imagery for calculating the extent of wound in the iris HMM image.

- Creating an iris-based kidney disease database (Trained and Tested database).
- Image preprocessing is used to convert the iris image from RGB to Grayscale.
- To remove noise from the iris image, a Canny edge filter is used.

- Image segmentation is the process of separating objects from the background of an image.
- The HMM Algorithm was used to detect kidney disease by analysing iris patterns.

II. LITERATURE SURVEY

The image from the CT scan is utilised to locate and identify the kidney wound. As a result, accurate information about the number of wounds and their location can be provided in various medical procedures. Tests that are performed manually and traditionally for medical purposes take longer and cost more money. Injury diagnosis in CT scan has become a more significant challenge for clinical diagnosis in recent years. CADD (Computer Aided Diagnosis) is necessary for medical testing advancement and efficiency improvement [13-17]. They built the two convolutions layers of morphology and altered the features pyramid network in rapid RCNN by merging four IOU thresholds of cascade RCNN [1].

Chronic kidney disease (CKD) is associated with a significant mortality rate since it is recognised as a global health problem that also involves other disorders. There may be no symptoms seen in the early stages of CKD. As a result, patients are ignorant of the condition. Early detection of CKD helps patients to receive treatment on a more regular basis, which slows the disease's progression. Because of their quick and exact recognition performance, machine learning models help doctors fulfil their goals more effectively. A machine learning model was presented for detecting CKD. The KNN algorithm can be used to fill in the missing data. The six machine learning techniques are implemented when the missing data set is efficiently filled. [2]

By scanning the iris, it is possible to determine the health of inner organs such as the kidneys, heart, and other organs [2,3,5,6,7]. They referred to a chart that Dr. Bernard Jensen had presented. The diagram shows a variety of damaged tissue patterns associated with dysfunctional organ diseases. The state of a certain organ in the human body is represented by broken tissue in the iris. A pattern or mark, or simply changing the colour of the iris, represents damaged tissue. Prior to this examination, anyone who had a renal ailment or had lost a kidney did not have any damaged tissue in their iris. [3]

The iris is related to a large number of nerves in the eye. Each and every aspect of the body is connected to the iris. Examining the iris' area of interest (ROI) reveals which section of the body is having issues. Here, the region of interest refers to the location in which he is interested. Because of the properties found in the iris, iridology has become the body's primary framework. The entire iris is considered in this study, ignoring the remainder of the eyes. The photos are categorised based on broken tissue, colour gradation, and a few other characteristics. The watershed technique is used to extract qualities from patients with broken tissue. Coronae has such straightforward properties that it may be captured with any video or picture equipment. The SVM supervised machine learning technique is used to detect whether the image of the iris has damaged tissue or any other properties on the ROI of the iris. [4]

Chronic Kidney Disease (CKD) progresses over months or years as kidney functions deteriorate. Kidney will not be able to detect till it has lost up to 25% of its capabilities. Because no symptoms are present at first, the patient is unable to recognise his or her renal or kidney failure. Wrapper and filter techniques are used to create CKD data sets. Each of these methods has its own evaluator. A good search engine is used to execute filter approach with CFs Subset Eval and Filter Subsets Eval." A good search engine is used for the wrapper technique between Classifier Subsets Eval and Wrapper Subset Eval. [5]

The iris diagnostic system cannot completely replace the handy diagnosis method; nonetheless, it is used as a screening level diagnosis and aids doctors. Because picture acquisition is the first step in iris diagnosis, image quality, accuracy, illumination, and the time required to capture and diagnose the iris system are all dependent on it. The crucial phase in the technique of iris diagnosis system localisation. When compared to other techniques, the localization procedure takes longer. Controlling the localization time is done by resizing and shrinking the image. [6]

Cropping the iris image is essential in this method. To achieve good cutting, the iris must first be captured clearly in order to obtain correct results. The first step is to convert the RGB image to a grayscale image, which is then filtered to remove the noise. The second stage involves extracting the pupil portion of the eye from the iris. The image is turned into a rectangle image in the third phase, and then the rectangular image is translated into a binary image. Finally, the image is compared to an Iridology chart to determine the condition. [7]

The state of internal organs can be predicted from the iris of a human. Iris patterns and colour are identified and compared to an Iridology chart. The Iridology chart divides the iris plane into segments, each of which corresponds to a different internal organ. This strategy is based on three procedures: Iris recognition, extraction, and dark/white regional localisation are the first three steps. It is possible to make a diagnosis by comparing the iris pattern to the Iridology chart. [8]

The iris is a greenish-yellow ring that surrounds the pupil. The sclera is the white component of the eye, and the cornea is the clear section in the middle. Iris is a part of the nervous system, which is made up of a million nerve endings and impulses. By evaluating the iris image, the overall process is carried out to obtain the correct estimate of sickness. In feature extraction, a Gabor filter algorithm is required. All needed features should be retrieved and thoroughly examined. [9]

Kidney disease is a societal problem that is becoming more prevalent as morbidity and mortality rates rise. Clinical trials and medical investigations require the possible identification of kidney disease or its absence through clinical analysis. One of the challenges is storing samples from patients with known renal diseases in medical bio repositories. Pathological results are combined with discharge summaries and billing codes to provide a comprehensive report. [10]

III. COMPARISON TABLE

Author	Approach	Description
HUI ZHANG, YURONG CHEN, YANAN SONG ZHENLIN XIONG, YIMIN YANG, Q.M. JONATHANWU	Phonology cascade vortex neural networks for detecting Kidney lesion.	They introduced a device which detects wound using multi-IOU (Intersection Over Union) based on the Convolutional Neural Network. Small wound in the kidney can be found out using deep learning algorithm (RCNN).
JIONGNIMGQIN, LIN CHEN, YUHUA LIU, CHUANJUN LIU, CHANGHAOFENG, BIN CHEN	Detection ofKidney problems using Machine Learning.	In this approach, they are collecting the data from the University, where it has a large number of missing data / values. It is difficult to get accurate results due to missing values. To fill these values, they used KNN (K-Nearest Neighbour) imputation method. After the missing values filled, Machine Learning algorithms: 1.Random forest algorithm 2.Logistic Regression algorithm 3.SVM algorithm 4.K-Nearest neighbour (KNN) 5.Naïve Bayes Classifier 6. Feed forward Neural Network, were used to complete this approach.
MAYA ARMYS ROMA SITORUS, ADHI WIBAWA, MAURIDHI HERY PURNOMO	Detection of Chronic renal failure through a watershed algorithm by analysing theiris image.	They classified the iris of image of patients suffering from chronic renal failure to various stages based on the region of interest of the eye. By analyzing the iris, it is possible to know the condition of the inner organ. They referred a chart that was introduced by the Dr. Bernard Jensen. The chart contains various broken tissue pattern with abnormalorgan conditions.
Sandhya Kumari, Bhagwate Dhiraj	Kidney disease detection through Iris Image.	They proposed a technique is based on finding the core of iris along with,they analyze the abnormalities in the iris of patient that compare to the kidneys to find the wounds or problems in the Kidney.

Hsueyin Polat, Hoday Danaei Mehr, Aydin Cetin	Using Support Vector Machine by feature selection method for detecting Chronic Kidney Conditions.	They used two methods to find Kidney problem 1. Wrapper and 2. Filter For Filter they used a greedy search engine cfsSubsetEval and best first search engine FilterSubsetEval. The greedy stepwise search engine was used for wrapper. Search engine used are: ClassifiersSubsetEval WrapperSubsetEval.
Sandeep Panwar Jogi, Bharat Sharma	Strategy for inspecting iris image for clinical check-up.	They extract the clinical data like unusual colors, spots, marks. After analyzing the iris, the iris image is being compared with the Iridology chart. Localization of the image is the important process and this takes a lot of time. By changing the size of the iris image, Localization time can be reduced.
Lavanya R, Sakana G, Praveen kumar E, GowdhaniD, Sivasaravana babu S	Early Stage Diagnosis of Disease in All Parts of Body using Iris Image	They proposed a computerized ideological system for detecting abnormal conditions in the body with the help of image processing through several stages.
Adrina Lodin, Sorina Demea	Iris design based on the clinical recognition approach	In this approach patient can receive the correct treatments based their iris tissues information. This approach is mainly depending on the three important procedures: 1.Iris Recognition 2.Extraction 3. Dark or white region Localization. They generate diagnosis based on Iridology chart.
Jyoti Prasad, Divya Patel,	Iris Based Medical	They used Gabor filter algorithm for feature
Megha Jadhav, Prof.Rupali Deshmukh	Analysis by Geometric Deformation Feature.	extraction, which is the most important process. By comparing the normal eye with diseased eye, they can find the abnormalities that were present in the diseased eye
Christoph Weber, Lema Roschke, Luise Modernsohn, Christina Lohr, Tobias Kolditz, Udo Hahn, Danny Ammon, Boris Betz, and Michal Kiehntopf	Enhanced detection of high-level Chronic Kidney Disease and its absence by merging various electronic health data by using machine learning strategy.	In this approach they are merged information from different resources like EHR (Electronic Health Record) to identify the kidney diseases. Also, they are comprising laboratory values, and other components. Various classification models were used, they are AUROC and AUCPR.

IV. METHODOLOGY

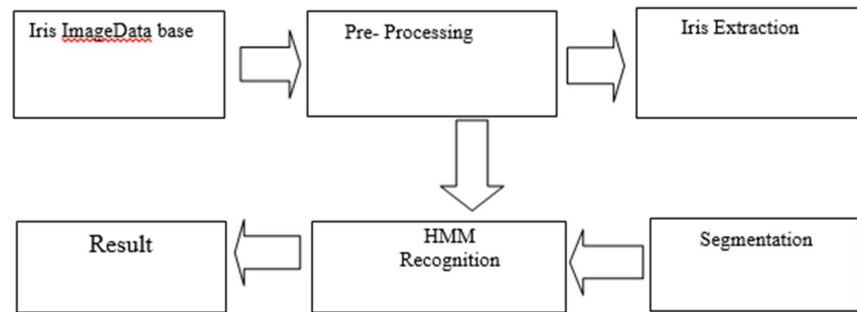


Figure. 1 Flow diagram of methodology

The state of a kidney can be determined by studying the image of the iris. The fundamental idea is to combine iridodiagnosis and picture editing to produce a novel form of investigation and medical detective work. This method is carried out by image processing, with the extraction of numerous iris features playing a key role. The iris image is used as an input for pre-processing, which is a stage in which the image's quality is improved through simple conversion

Grayscale Adjusted Image: To perform this operation, the image's resolution is decreased during the normalization procedure. The unwanted portion of the image is deleted and the resolution is increased to the acceptable level. Histogram equalisation is used to increase the picture's diversity.

Edge Detected Image: The Hough transform is applied to the inner and outer planes of the iris, and edge detection operators are employed to determine the iris dimension

Iris Detection and segmentation: To locate iris, a set of data is separated via feature extraction. When the iris is recognised, it uses hog and Gabor filters to receive the structure of the face. By scanning the image, this percolate used boundary detection and direction values to obtain the face structure.

Image Pre-Processing: Entity finder is used to locate an iris in an image by searching through a set of data. A MATLAB method for detecting the iris is the cascade entity.

Iris Image Database: The trained data & tested data is stored in a database file, which is an iris image data base.

RGB to Gray Image: Colored iris images are obtained from the train and test databases. To save the cost of calculation and storage space, these photos were converted to grayscale.

Extract Iris: Following the detection of an iris in one frame, the step function is utilised to detect the iris in subsequent frames in order to execute iris extraction. A feature is required to inspect the various movements of the face in serial frames in order to accomplish iris extraction.

Feature extraction: To begin, upload all of the training images and convert each RGB colour to grayscale to obtain one sample in each pixel. The white Gaussian filter serves as a feature descriptor for extracting features from photos.

Introduction to HMM: Hidden Markov Models are related with learning algorithms that evaluate information used for separation and regression inspection in machine learning. A separating hyper plane defines HMM.

Grayscale Images: A grayscale image is a data matrix with values that represent intensities within a specific range. A Grayscale image is saved in MATLAB as a unique matrix, with each matrix value corresponding to one image pixel.

V. CONCLUSION

Machine Learning and MATLAB will be used to create a Novel Approach to Detect Kidney Disease Through IRIS. It's used as a guide for examining the iris image to check for various kidney problems. As a result, it's used as a practical criterion for scanning kidney disorders using iris scans. Checking the iris photographs allows for more research into the organ's condition. Using edge detection and segmentation, the software is able to categorise the data. The iris recognition technology appears to display suitable answers based on the results of the tests.

REFERENCES

- [1] J. Jiang, P. Trundle, and J. Ren, "Medical image analysis with artificial neural networks," *Compute. Med. Image. Graph.*, vol. 34, no. 8, pp. 617-631, Dec. 2010.
- [2] L. Zhang et al., "Prevalence of chronic kidney disease in china: a cross-sectional survey," *Lancet*, vol. 379, pp. 815-822, Aug. 2012.
- [3] M. Noll, X. Li, and S. Wesarg, "Automated kidney detection and segmentation in 3D ultrasound," in *Proc. Workshop Clin. Image-Based Procedures*, Sep. 2014, pp. 83-90.
- [4] A.M. Cueto-Manzano et al., "Prevalence of chronic kidney disease in an adult population," *Arch. Med. Res.*, vol. 45, no. 6, pp. 507-513, Aug. 2014.
- [5] Singh et al., "Incorporating temporal EHR data in predictive models for risk stratification of renal function deterioration," *J. Biomed. Inform.* vol. 53, pp. 220-228, Feb. 2015.
- [6] M. Zhang, T. Wu, and K. M. Bennett, "A novel Hessian based algorithm for rat kidney glomerulus detection in 3D MRI," *Proc. SPIE, Med. Imag., Image Process. Int. Soc. Opt. Photon.*, vol. 9413, Mar. 2015, Art. no. 94132N9.
- [7] Z. Chen et al., "Diagnosis of patients with chronic kidney disease by using two fuzzy classifiers," *Chemometr. Intell. Lab.*, vol. 153, pp. 140-145, Apr. 2016.
- [8] H. Polat, H.D. Mehr, A. Cetin, "Diagnosis of chronic kidney disease based on support vector machine by feature selection methods," *J. Med. Syst.*, vol. 41, no. 4, Apr. 2017.
- [9] P. T. Akkasaligar and S. Biradar, "Diagnosis of renal calculus disease in medical ultrasound images," in *Proc. IEEE Int. Conf. Comput. Intell. Comput. Res. (ICCCIC)*, Dec. 2017, pp. 1-5.
- [10] A Subasi, E. Alickovic, J. Kevric, "Diagnosis of chronic kidney disease by using random forest," in *Proc. Int. Conf. Medical and Biological Engineering*, Mar. 2017, pp. 589-594.
- [11] Y. Xie, B. Bowe, and H. A. Mokdad, H. Xian, Y. Yan, T. Li, G. Maddukuri, C. Tsai, T. Floyd, and Z. Al-Aly, "Analysis of the global burden of disease study highlights the global, regional, and national trends of chronic kidney disease epidemiology from 1990 to 2016," *Kidney Int.*, vol. 94, no. 3, pp. 567-581, Sep. 2018.
- [12] M. Shehata, F. Khalifa, A. Soliman, M. Ghazal, F. Taher, M.A. El-Ghar, A. C. Dwyer, G. Gimel'farb, R. S. Keynton, and A. El-Baz, "Computer aided diagnostic system for early detection of acute renal transplant rejection using diffusion-weighted MRI," *IEEE Trans. Biomed. Eng.*, vol. 66, no. 2, pp. 539-552, Feb. 2019.
- [13] Optimized Identification of Advanced Chronic Kidney Disease and Absence of Kidney Disease by Combining Different Electronic Health Data Resources and by Applying Machine Learning Strategies, June 2020.
- [14] Shankar, K., Lakshmanaprabu, S.K., Gupta, D. et al. Optimal feature-based multi-kernel SVM approach for thyroid disease classification. *J Supercomput* 76, 1128–1143 (2020). <https://doi.org/10.1007/s11227-018-2469-4>
- [15] Le, DN., Parvathy, V.S., Gupta, D. et al. IoT enabled depthwise separable convolution neural network with deep support vector machine for COVID-19 diagnosis and classification. *Int. J. Mach. Learn. & Cyber.* (2021). <https://doi.org/10.1007/s13042-020-01248-7>
- [16] Anupama, C.S.S., Sivaram, M., Lydia, E.L. et al. Synergic deep learning model-based automated detection and classification of brain intracranial hemorrhage images in wearable networks. *Pers Ubiquit Comput* (2020). <https://doi.org/10.1007/s00779-020-01492-2>
- [17] Shankar, K., Sait, A. R. W., Gupta, D., Lakshmanaprabu, S. K., Khanna, A., & Pandey, H. M. (2020). Automated detection and classification of fundus diabetic retinopathy images using synergic deep learning model. *Pattern Recognition Letters*, 133, 210-216.