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Diagnosis of heart disease and hyperacidity of stomach through iridology based on the neural network

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Abstract

The main objective of this study is to evaluate the disease diagnosis through iridology by neural network that uses eye structure and a mechanism to diagnose accurately the iris position and matching with iridology pattern evaluating the accurate positions. So, the offered software evaluates accurately iris tissue through edge detection and then analyzes the intended area according to the disease type and finally by the neural network, evaluates learning and prediction in health area. The risks of a lack of accurate and rapid disease detection with a high cost of diagnosis is considered as one of the problems of medical society. Creation of a mechanism to manage the volume of patient information and effective use of them to improve decision-making is one the controversial topics in this era. One of the important issues in computer science research, is to implement a similar model to the internal system of the human brain to analyze different systems based on the experience. In this regard, neural networks are one of the most dynamic areas of research in this era and using neural networks to solve the applicable complicated problems has increased these days. The architecture of the offered model contains 4 main sections of receiver block, processing block, matching block and decision block that this section detects based on a pattern or disease symptoms in the region to accept or reject.

Keywords: iridology, edge detection, neural network, image processing

Introduction:

One of the main issues in the society today, is in the treatment area that concerns many experts and users as well as the vast expansion of neural networks application in engineering, medical, military, aerospace and telecommunication sciences and etc causes many studies to be conducted in and out of the country in this area. It is rapid detection of a disease and the accuracy of diagnosis through iridology. In iridology, the colored part of the eye is called iris which is placed under the cornea and is formed before the birth and almost does not change until death. This muscle has a series of distinct characteristics such as lines, circles, holes, grooves, fibers and stains. Iris of all people is different from each other which means no two irises are alike in the world. A careful and close examination can help us to identify the past way of life of people and cause to diagnose the disease, so that with a change in the way of life in the first step, progression of a disease can be prevented and in the later stages it can be treated. Iridology is a form of disease diagnosis which examines colors and the other characteristics of the anterior fibers of the iris to be informed about the patient's health. Experts adopt their observations with the iris charts which divides it into many area. Physicians believe that each of these areas is related to a part of body and iris has the ability to show the change in the situation in each part of body. The experts in iridology can diagnose the systems and organs of the body which are healthy or the parts which are "hyperactive" or inflamed. These symptoms reflect health issues in the past or prediction of health problems that may occur in the future for patient's specific disease. Iridology is used as the first step in disease diagnosis. Iridology is an alternative way for accurate diagnosis with a minimum cost and high efficacy to fill the patient's case in the shortest time and finally save the patient's time in the start of treatment period and so it has reduced the risks due to the delay in diagnosis of the disease and improved the diagnosis acceleration. Neural network can be used to diagnose the disease that in this research, a system is used to create a mechanism to diagnose the disease through iris by a reliable and accurate method on the standard images samples of eyes (CASIA Iris Image Database) as well as the collected images from several hospitals including Zafar Hospital, Shohada-e Kargar Hospital, Shahid Sadughi Hospital and the clinic of an expert in traditional medicine in Yazd. The implemented system includes some sub-systems which is written between each step of the software that all has been normalized using the segmentation and normalization and extraction of the matrix features and finally and has been matched with a trained neural network to evaluate and compare to find the patient's disease among the recorded information.

2- Theory and literature

2-1- Introduction of iridology science in disease diagnosis

Iridology was established at the early of twentieth century in America and its primary founder was Dr. Henry Edward Lane and after him, Dr. Lindlahr continued the study and wrote a book titled nature treatment and after that in 1919, published a series books of six volumes in this regard with the name of "diagnosis through the iris". In 1922, Dr. Bernard Jensen studied with Dr. Lindlahr in Chicago and then with McLain in San Francisco for four years as well as the famous iridologist, Dr. Collins, writer of "Diagnosis through eye observation" (1).

In 1996, an active imaging system which has been developed by Sensar Company's license, has used the specific cameras to get iris images at a distance of up to one meter. This active imaging system was set in automated teller machines in some successful applicable tests by two companies of NCR and Diebold in several countries during 1997-1999 (1, 2). Disease diagnosis through iridology is unique. The offered software uses the edge detection to diagnose a special area on digital image of iris, analyze the special area and artificial neural network to learn and predict health. For this study, the prediction conditions of health were considered for a number of diseases. The advantage of this computer system is a more accurate measurement than the traditional methods in iris segmentation, boundary detection and color identification (2). Today, researchers are trying to design and implement the software on iris images which diagnose diseases with minimal computational complexity and the most accuracy because in the

previous method, the pattern volumes were very high and the very expensive technology was not user-friendly and benchmarking may not be accurate (5).

2-3- Diagnosis of heart disease and hyperacidity of the stomach through iridology

Diagnosis of heart disease and hyperacidity of the stomach has been done through iridology. First, the available phases in the process will be discussed and then each phase will be reviewed completely.

- Pre-processing phase
- Normalization phase
- Features extraction phase
- Matching phase (neural network training)
- Evaluation phase
- Conclusion phase

Pre-processing phase

At this stage, evaluating the separation and segregation of the iris and the eyelids from the eye image, separating the internal bounder and calculating the radius and the center of the pupil of the eye, eyelid separation and determining the bounder between the eyelids and iris, separating the external bounder and calculating the radius and the center of the iris are done. For the separation process, edge detection method is used by Canny method. Then, Hough Transform and Hysteresis were used to determine the boundaries and to detect and increase the edge thickness of eye respectively, that lead to detect the iris area from the eye structure and remove the eyelashes, eyelids and pupils. ANW is one of the important characteristics for physicians in the iris analysis of the eye. In figure 1, classification of the eye regions is shown which is for determining the organs of the individual's body. Disease diagnosis through iris as a unique organ can be considered as a comprehensive method for diagnosis and treatment. The accurate diagnosis of iris tissue is a main step in iridology to extract the iris codes.

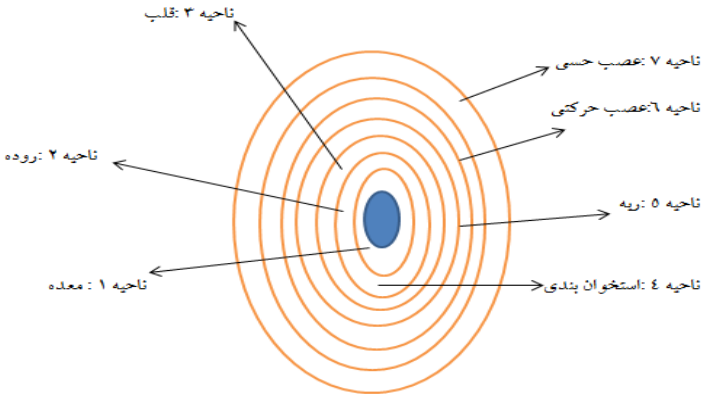


Figure 1- ANW regions classification

Disease diagnosis through iris as a unique organ can be considered as a comprehensive method for diagnosis and treatment. The accurate diagnosis of iris tissue is a main step in iridology to extract the iris codes. According to ANW, the stomach and heart regions are at the regions 1 and 3, respectively.

Separation of iris and eyelids from the eye image

The main goal of this stage is to determine the iris boundaries, the internal boundary between iris and pupil and the external iris between iris and sclera associated with their centers and the radius of each as well as the boundary between eyelids and internal section of the eye. Iris is considered as two nested eccentric circles that eyelids and eyelashes have blocked its upper and lower and eyelids are considered as two parabolas in the upper and lower of iris.

Separation of the internal boundary and calculation of the radius and center of eye pupil

Separation of pupil from the other sections of image is done through Canny edge detection method. The light intensity of pupil is lower than the rest of the eye points, also difference of light intensity in pupil with the neighboring areas is very high. With this method, three parameters related to the center and the radius of the boundary circle are determined. Disadvantage of Hough Transform is a lot of calculation which is time-consuming. To solve this problem, limiting the searched area and reducing the image dimensions are used.

Separation of eyelids and determination of the boundary between eyelids and iris

Upper and lower parts of iris are blocked by the upper and lower eyelids and thus a part of information is lost and another information is replaced and due to the blockage rate and the resulted unwanted information which were entered to the system is changed depended on different situation, it is necessary to identify and remove the points related to these disturbances.

To obtain the boundary between the upper eyelid and the iris, the candidate edge points were found using Canny edge founder at first. With an accurate observation of different eye images, it is found that a quadratic equation can be used to get the upper eyelid with a good approximation. Therefore, according to the function of quadratic equation, we can find a number of points and use the method of at least squares error to obtain the quadratic equation. In the using method in this thesis, a number of points from the eyelid boundary were selected at first and then using the method of least squares, the quadratic equation of the boundary of upper eyelid is obtained.

To find the boundary between the lower eyelid and iris, a similar algorithm to finding the boundary of upper eyelid was used. Only in finding points from the boundary to pass the curve from them, the obtained points are very sensitive to noise because the lower eyelid is not very clear. First, the related sections to the pupil and upper that were removed from the image and then mask was used to obtain the edges.

Separation of the external boundary and calculation of the radius and center of iris of the eye

The most important and complicated part of segmentation is finding of the external boundary of iris and the boundary between iris and sclera, because firstly there is not a fully clear boundary in this region and the available boundary is scattered, secondly there are another boundaries in the eye image that changes of light intensity are very high in them. Thus in the stage of separating the external boundary of iris, a method should be provided to be able to detect the unwanted edge points and remove them. Since, the success of later stages of diagnosis system of disease is very much depended on this stage, so obtaining the results of this stage should be very careful.

After improvement of the image quality to extract the external boundary of iris and remove all image disturbances, we reach to the step of finding the external circle. In this step like the previous one, Hough Transform was used to find the parameters of external circle and to speed up the process of this stage and with regard to the pupil and iris centers despite of being eccentric are very close to each other, the searched area for the iris center is limited to a window around and pupil in the center. With solving of Hough equation with three parameters, the characteristics of the external circle of iris are obtained.

Normalization phase

In segmentation section, the iris boundary with other sections is estimated but in normalization, regions of iris are obtained for equality. The normalization is done using the plastic screen of Dugman. This model changes the Cartesian coordinates of iris tissue to the polar coordinates. This process is called opening of iris that its result is a rectangle that is used for further processing. Cartesian to polar conversion is such that the pixels of the iris area becomes completely a pair of polar coordinates (r, θ), that r is a radius in the distance of [0, 1] and θ is an angle in [02, π].

The test of this article is based on Dugman method, so that the iris region is obtained as a normalized band with respect to the iris boundaries and pupil center. The normalization process resulted in producing a two-dimensional matrix of iris region that its horizontal and vertical lines indicate the angular resolution and radial accuracy, respectively. Due to Dugman model was used for normalization, we will rotation problem in matching phase.

Feature extraction

After finding the internal and external boundaries of iris and writing this area on a rectangular bar with dimensions of 64×512, we should extract a feature vector from the obtained bar. This feature vector should use the unique features of iris tissue and be different for each disease. The obtained vector has to code the available important information in iris tissue to be able to compare the input image and the recorded code successfully. Feature extraction is the most important part of the system that the obtained feature vector in it should have too small dimensions in addition to containing all available important information in the iris tissue, as the vectors with large dimensions not only need a lot of space for recording, but also impose high volume of calculations in extraction and matching steps to the system.

Matching

The obtained matrix from the feature extraction process needs a matching and comparison criteria to provide a size as an output which shows the disease on that region of iris. In fact, the feature matrix of the previous step is as the input of neural network and number of disease is considered the output and we can obtain the matching rate of each sample by neural network training. Finally, the obtained output is compared with the real output. The goal is to design a network that is trained by the training data at first and then by giving the input matrix related to a kind of disease to the network that may already have learned it or not to recognize its class.

Iris segmentation, separation the boundary of iris and pupil is a difficult work. If the iris area have not divided properly, there is a possibility of noise. Four types of area must be properly segmented to detection performance trend is done more accurately such as eyelashes, eyelids, reflections and pupil (8). There are several ways to eliminate noise that edge detection is applied in this study.

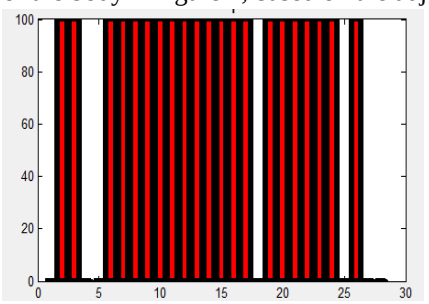
Normalization, in order to extract the value from the iris image. At this stage, conversion of the image of each point of iris area (polar coordinates) to Cartesian coordinates was performed. In normalization, considering a reference point from the center of eye pupil and radius vector, passing from the iris region is performed. In the matching process in which organs are evaluated according to the map of iridology and leads to finding of the intended limb, that disruption in heart and hyperacidity of stomach has been discussed in this paper and the process is shown in figure 2.

3- Recommended method

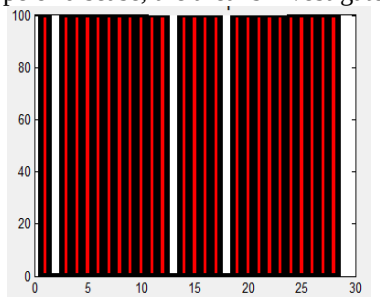
An algorithm is proposed to solve these problems. If the iris detection system is developed, a proper, accurate and effective system can be provided to detect diseases. Disease detection through iris using the neural network is one of the reliable and available methods in health area that the degree of accuracy of this method increases using the stable and accurate equipment in imaging.

4- Implementation and evaluation of the recommended method

To diagnose the pattern, it is necessary for the neural network to match a high volume of input information concurrently and produce a total or classified output, so that this output is a reasonable response to the incomplete or distorted input data. Neural networks recognize the patterns well, even if the forming information of the pattern are confusing, fragmented or incomplete. Figure 3 shows the detection process of diseases in the recommended method. Iris map has determined all regions and organs of the body in figure 4, based on the adjusted depending on the type of disease, the area is investigated.



Percentage of heart disease



Percentage of hyperacidity of stomach

Fig 3- detection process of diseases based on the recommended method

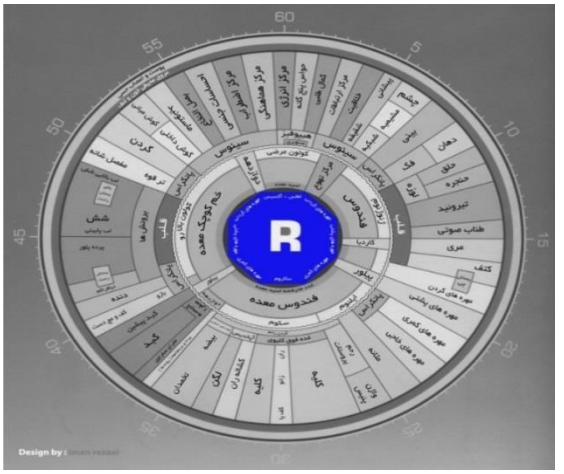
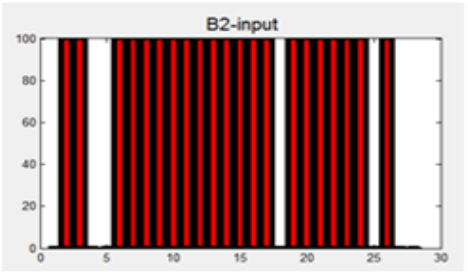


Figure 4- Iris map [1, 11]

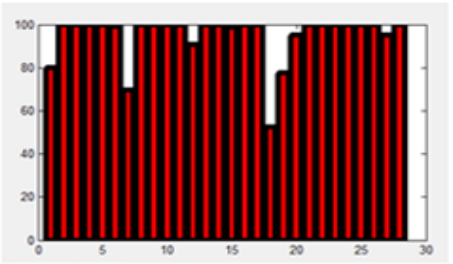
The positive and negative errors of our recommended method is alike Dagman method. The most important part is valuation of iris in finding the boundary of pupil and iris. Finding the external area of iris is performed based on Dagman. As a result, reduction in processing rate and consequently reduction in detection time. Diagnosis of a disease through iris is more reliable and there are not two humans with the same surface texture. Also, we try to make it possible for it to detect several diseases not a single one.

In this part, evaluation of the results will be discussed. First, output of the trained network is given to the network again as the input to measure the accuracy of the network performance. The accuracy of this system, 98.28% were detected properly and 1.72% in error. So the provided algorithm based on iris pattern can be developed to diagnose the other diseases. In this step, diagnosis of hyperacidity of stomach

is evaluated in the eye iris. In figure 5, part A, the graph shows the evaluation and accuracy of heart disease in the iris and in part B, the chance percentage of heart disease is determined in the neural network.



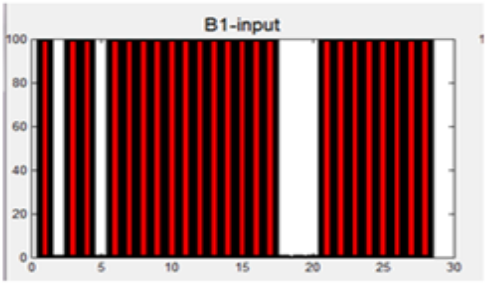
B) the chance percentage of heart disease in the neural network



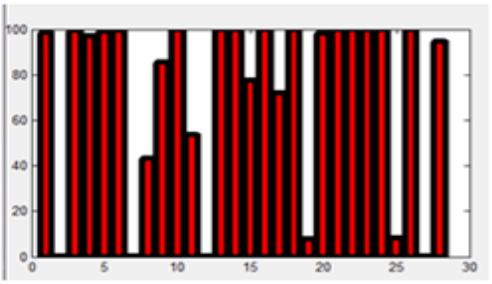
A) Evaluation and accuracy of heart disease in the iris

Figure 5- graph of evaluation and accuracy of the obtained result in the recommended method

Diagnosis of hyperacidity of stomach through the iris is discussed in following, figure 6 in part A, is a graph which shows evaluation and accuracy of heart disease in the iris and in part B, the chance percentage of hyper acidity disease of stomach in the neural network. In the evaluated graphs, the horizontal axis and vertical axis show the patients and chance of disease, respectively.



B) the chance percentage of hyperacidity disease of stomach in the neural network



A) graph of evaluation and accuracy of hyperacidity disease of stomach in iris

Figure 6- graph of evaluation and accuracy of the obtained result in the recommended method

4-1- Comparison of the recommended system with the previous systems

One of the problems right now for patients is the rapid and accurate diagnosis of disease which this system using the neural network tries to facilitate the diagnosis process for the physician. For example, a problem which heart patients face to it, is the weakness in the diagnosis of this disease at the early stages. Diagnosis will be possible at the early stages of the disease with this method. In the recommended method, there is the ability to diagnose several diseases concurrently and unlike the previous approaches that were only one-dimensional as well as diagnosis the iris tissue which is one the most important issues of the key element method, the problem of non-ideal iris could be largely solved. For example, in the

diagnosis method of cholesterol disease through iris using the image processing with thresholding method, in addition to being limited to the detection of one disease which is considered as a weakness of this process, while thresholding method is used, the noise problem can turn into a insoluble problem. At a time when there is no possibility of noise reduction in the source, the method which should be used to improve performance is smoothing before thresholding. Also, in the diagnosis of colon disease due to the excessive dependence to ANW in diagnosis of the iris regions in detecting process of disease, is considered as one of the weaknesses of this method.

Discussion and conclusion and recommendations

The recommended system for disease diagnosis through iridology by neural network is proposed which this method can be used for cases such as prevention as well as rapid diagnosis of specific diseases. According to the previous studies, these weaknesses are still alive. Being limited in number of disease diagnosis, no non-ideal iris processing and also the ability to detect the presence or absence of a disease are of them. To solve these problems, an algorithm has been provided as the recommended method. If the iris detection system can be developed, a proper, accurate and effective system will be provided to detect and diagnose the disease. Detecting the disease through iris is one of the reliable and accessible methods in the health area and the accuracy degree of this method will increase using the stable and accurate equipment in imaging.

Constituent parts of the system which combines artificial intelligence and medicine can be used appropriately, so that it is enough to receive the input images which are the same images that eye sees and then positioning the iris, removing eyelids and eyelashes,… and after positioning, normalization from the point (0, 0) at the right of eye and image of iris circle are done to removing noise and image optimization is possible. Then histogram graph is plotted and the normalized output is given to the neural network as an input. Network is trained and then matched with the available pattern and finally it is evaluated whether the disease exists or not?

This method is able to detect several diseases at the same time unlike the previous methods which were only one-dimensional. In regards to non-ideal iris, it could solve largely this problem with a more accurate diagnosis of the iris tissue. With the development, diagnosis of diseases through iris by the neural network can be a great help in saving time and cost to detect and treat the disease. The standing existing problems, being time-consuming to calculate the exact location of the iris as well as edge detection operations which frequently occurs due to the heavy calculations, optimization of the related functions seems very necessary. Also, the need to evaluate the more accurate angle of eye, more accurate eye spin, a complete removal of non-ideal iris problem and adding more precision for inherited diseases are discussed to detect the diseases more accurately in the areas closer to each other.

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