

An Iris based Lungs Pre-diagnostic System

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Abstract—

Human lungs are essential respiratory organs. Different Obstructive Lung Diseases (OLD) such as bronchitis, asthma, lungs cancer etc. affects the respiration. Diagnosing OLD in the initial stage is better than diagnosing and curing them later. The delay in diagnosing OLD is due to expensive diagnosing tool and experts requirement. Therefore, a non-invasive diagnosing tool for OLD is required that identifies dysfunctional lungs without the support of expert, complex and expensive diagnosing types of equipment. In this work, we design an Iris based Lungs Pre-diagnostic System (ILPS). The ILPS takes iris images as input and identifies dysfunctional Lungs based on iridology map. While testing with 50 lungs patients, the results confirm that the ILPS identifies dysfunctional lungs patients with an accuracy of 88%.

Iridology, Health-care, Embedded Computer Vision, Artificial Intelligence,

I. INTRODUCTION

Diagnosis of human organs such as lungs [1] malfunctioning [2] is an expensive, complex and time-consuming [3] process. If not diagnosed well in-time, the outcomes may be fatal. There are multiple factors that affect the early diagnosis that include unavailability of the required technology or approach to such techniques in rural areas and scarcity of relevant experts. A fast, cheap and accurate diagnosis is the need of the hour that can save many precious lives.

Iridology [4] is a practice of identifying conditions of human organs and tissues. Conventionally iridologists identify a problem by taking the image of irises (Left and Right eye) of a subject. The technique requires authorization by using a camera and recognizing each iris on display. Throughout the ages, the human eyes were claimed to be the windows of the soul [5]. With the introduction of iris-based research the eyes are now acknowledged as the mirrors for the human body health. The eyes are connected with the brains Dura mater through the fibrous sheath of the optic nerves, and iris of the eye is connected directly to the sympathetic nervous system and spinal cord. The iris has certain features such as crypts, lines, and lesions, which relates to the body constitution, inherent weaknesses, the level of health and the transition that takes place in the human body. The study of the iris is called iridology and is referred to as a map of the human body. It presents different human dysfunctionalities such as nutritional imbalance, a degree of illness and past injuries [6].

According to the study of iridologists, when any change takes place inside the body other than regular activities, the

mark or point appears in the iris. This mark or point is the description of the change in particular body organ or system. These changes in iris help to identify the specific disease. The iridologist charts and iris images are used to identify different disease like Diabetes, high blood pressure, diseases related to liver, digestive system and skin disorders.

In medical practice, fast, cheap and accurate diagnosis can save many precious lives. In-Vivo, ex-Vivo, in-vitro and many more microbiological and pathological techniques are in practice for the diagnosis of different diseases. All of these techniques require highly hygienic labs, heavy duty expensive equipments, and samples which are painfully drained from the human body.

A number of iridology based lungs dysfunctional algorithms and applications are proposed in the past. These algorithms are programmed for analysis and do not operate as a stand-alone system. Designing a real-time stand-alone graphics system [7] [8] that manages an enormous volume of patient images [9] information and effectively use them to make a decision is a complex and controversial topic. Therefore, an intelligent stand-alone high performance [10] iridology based disease diagnosis system is required for research and academia to study and analyze different diseases and implement an artificial mechanism to diagnose them.

In this work we propose a non invasive Iris based Lungs Pre-diagnostic System (ILPS). The proposed system uses artificial intelligent algorithm that can identify the lung malfunction using iridology chart. The algorithm takes iris image in real-time and processes algorithm on high performance computing system. The ILPS takes iris images of patients having dysfunctional lungs by using an iridology camera and performs training and testing. During training phase the ILPS takes iris images of healthy and dysfunctional lungs classify subject extract features using gabor filter [11] and label respective features. During the testing phase, the ILPS takes real-time iris image of a person, extracts features using Gabor filter, and by using Support Vector Machine classifier and iridology map, classifies the person as lungs dysfunctional or healthy. In order to validate the ILPS, we tested it on 200 persons, among which half were the patients of lungs problems while the other half were the healthy person.

II. RELATED WORK

Studies have been conducted for the analysis of iridology chart in order to identify iris based diseases.

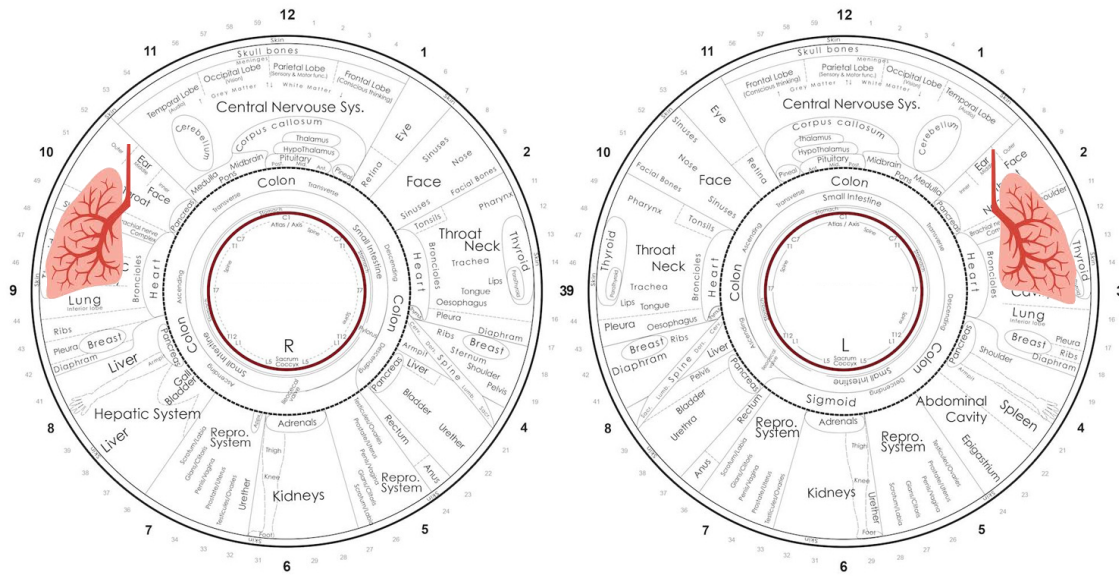


Fig. 1. Iridology Chart Showing Left and Right Iris Images and their Relations with Human Lungs

Anna et al. [12] have used Adaptive Resonance theory (ART), which is one kind of artificial neural network which uses unsupervised learning algorithms. In order to detect lung disorders, they have designed a system which goes through a number of steps starting from segmentation, extraction of color variation, transformation of lung and pleura representation area in iris image to binary form as the input of ART1, and pattern recognition by ART1 neural network architecture. ART is expected to be one of the best stable and adaptable solution in changing environment of pattern recognition.

Salles et al. [13] studied the prevalence of iridologic signs of Diabetes Mellitus. Pancreas signs, Cross of Andreas and related risk signs for the disease were considered. They investigated data from 97 individuals suffering from diabetes. Cross of Andreas and diabetes signs were identified and confirmed after analysis of irises. Mean, median and standard deviation is used for quantitative variables. The existence of signs were found to be 89% and 98% for the Cross of Andreas and Pancreas related diseases. Salles et al. [14] conducted research on the sign of Cross of Andreas in iris and Diabetes Mellitus. It was a longitudinal study in which 91 patients were observed and divided into two groups, one having a sign of Andreas and other with no signs. The group of people, who had a sign of Cross by Andreas at the start of the study, was later diagnosed with diabetes after four years. Kruskal-Wallis and Mann-Whitney methods are used for the comparison of signs of diabetes. It was concluded that iridology may work as a pre-diagnostic tool to treat patient earlier and avoid severe medical conditions.

Othman et al. [15] presented a primary study on iris recognition method for tissues of body organs. They used an innovative segmentation technique known as water flow method. The water flow analogy was used owing to its geometrical elasticity and topological flexibility. However, the study was a pilot research work with no substantial conclusion. Ramlee et al. [16] projected an iris algorithm for Cholesterol detection by

a non-invasive method. Libor mask's and John Daugman [17] iris recognition methods were used to detect cholesterol to categorize sodium rings or Arcus lipids in the iris. It was again a pilot study, which requires further investigation for its validity.

Sivasankar et al. [18] proposed an algorithm to analyze tissue imbalance using iris images. Fuzzy C-means were used to identify iris features such as lesions. Acute, sub-acute and chronic stages were identified by using iris sign and gray level analysis. Thirty two irises having pulmonary conditions such as Asthma, Cold, Lung cancer and Wheezing are evaluated. Overall efficiency was found to be 84% and the efficiency was calculated by the false rejection rate and false acceptance rate. Tathte et al. [19] proposed a method for detecting diabetes by analyzing health condition from iris images. ROI extraction was done according to the iridology chart to evaluate the desired feature for diabetes. Adrian et al. [20] proposed an iris based diagnosis method that used iris images for medical purposes. Their proposed model was based on designing a method for semi-automatic or automatic biometric method for medical diagnosis. In their study, they related different irises with medical pathologies with the help of iridologist charts. The mark on iris is detected by comparing pixels and using the value of basic color. These iris charts formulated by iridologist for the segmented iris, in which every segment represents the internal organ. The competency of the final analysis has inclined by the level of details of the iridology chart and by the expertise of the operator.

Chaskar et al. [21] investigated a new method of diabetes detection from iris by using support vector machine. It was a non-invasive method for diabetes (type II) detection in the body by iris recognition. Features were extracted by using image enhancement techniques and region of interest has extracted. The accuracy rate of this model was 90-92%. Support vector machine was used for training sets and to differentiate between the normal or diabetic iris.

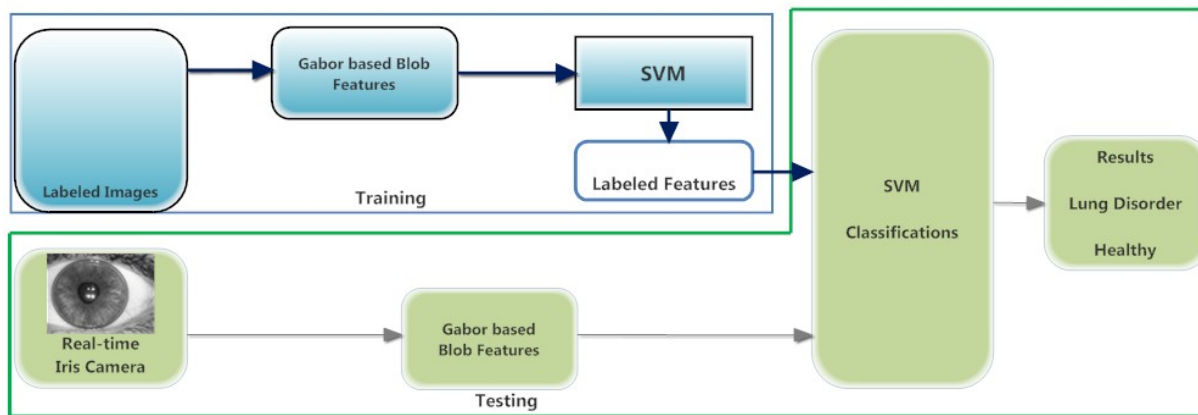


Fig. 2. Block Diagram of ILPS Algorithm

Sarika et al. [22] developed an automated method to detect Cholesterol by using iris recognition algorithm of Daugman rubber sheet model and Hough transform. Approximately 70 normal and affected images are collected. Sodium rings appear in person having a high cholesterol level. The histogram was used to analyze the ring and Otsu algorithm [23] to differentiate between pixel levels. Training sets were trained by using multilayer perception to determine accuracy. The result presented window on MATLAB with message either ring was detected or not. Banzi et al. [24] developed a real time model for early detection of diabetes. Colour coding and visual inspection methods are used to detect pancreas to identify diabetes. Median, mean and Gabor filtering techniques are used for surface segmentation. 10 patients were examined out of which 8 patients showed the correct results in comparison with medical reports. Training was done through artificial neural networks and provide accuracy of 100%. To conclude, iridology is a supreme pre-diagnostic tool.

III. IRIS BASED LUNGS PRE-DIAGNOSTIC SYSTEM

In this section we explain the Iris based Lungs Pre-diagnostic System (ILPS). The section is further divided into three main sections: the Lungs Pathology, the Hardware Architecture and the Algorithm.

A. Lungs Pathology

Based on the data collected from the clinical examinations, different features and patterns for lungs dysfunctions are described using the Iridology chart (Figure 1). This study shows the weakness of lungs organ inside the human body. The Lungs disorders can be observed in the Iris regions (shown in Figure 3) between segment 2, 3 and 4 in the left Iris after second concentric circle and between segment 8, 9 and 10 in the right Iris. This shows the presence of different lungs disorders such as bronchitis and asthma. In the left Iris pattern, mucus can be seen as the white clouds around the outside of the Iris. As the mucus is in the left eye this represents left lung disorder. Several spots can be viewed as a white clouds/pattern in above-mentioned segments of iris. These marks or patterns are the result of different lungs problems such as mucus,

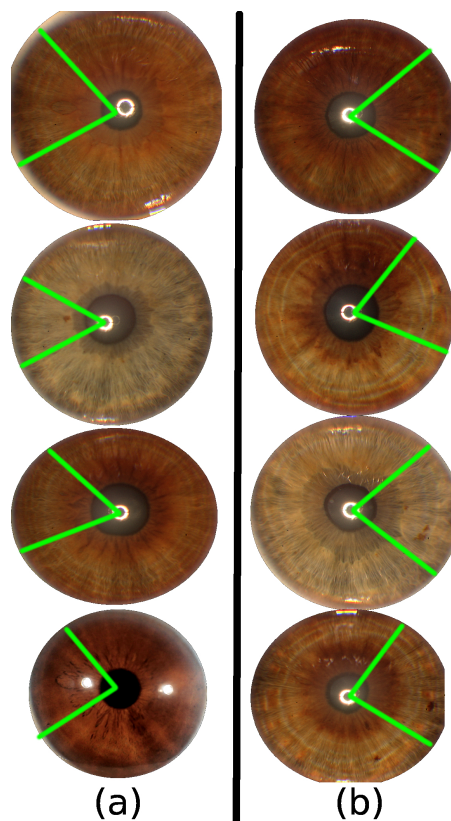


Fig. 3. (a) Right and (b) Left Iris Image of Patient having Dysfunctional Lungs

bronchi, asthma etc. Therefore if the marks are seen in the left or right eyes this shows the presence of a problem in the relevant lung.

B. Algorithm

The block diagram of the ILPS Algorithm is shown in Figure 2. The IPLS performs features extraction, features labeling and classification. Gabor features based blob detector is employed that extracts features based on different color and contrast patterns. Later Support Vector Machine is used that takes the blob features from specific iris segments label the

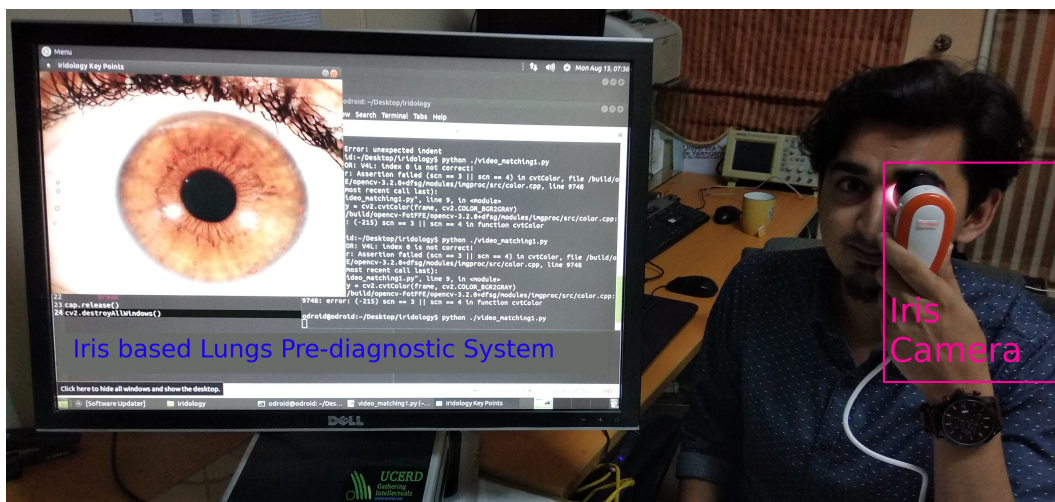


Fig. 4. Photograph of ILPS based System Testing

features. Like conventional machine learning algorithm the ILPS algorithm performs training and testing. During training the ILPS algorithm takes trained data-sets of 100 healthy persons and 100 Lungs patients and extracts features from each data-set and label them as trained features. During testing mode, the algorithm takes real-time iris image from a subject, extracts features, compares extracted features with the trained features and classifies subject as healthy or lungs patient.

C. Hardware Architecture

The ILPS Hardware Architecture holds multiple processing nodes [25]. In the current project, we practiced three nodes based high performance computing system. Each node of the system Architecture utilizes the multi-RISC processor and GPU-accelerated cores, which comprises General Purpose (Intel/AMD) multi-core processor and Graphical Processing Unit GPU. Each node uses an Intel Xeon X5550 general purpose processor and Nvidia GTX1080 GPU having 2560 Cuda cores. GPUs are used to reduce the cost and power conception and give data level parallelism. The ILPS system architecture uses Linux based operating system and uses open source and easy to program artificial intelligent frameworks such as (Tensorflow and CAFFE etc.).

IV. RESULTS AND DISCUSSION

The testing setup of ILPS is shown in Figure 4. The section is further categorized into 2 subsections; the Datasets and the Classification Accuracy.

A. Datasets

This section discusses the datasets that are used to test the ILPS. The datasets are further categorized into Training Data and Testing Data. Each dataset holds 100 iris images; 50 patients with lungs problems and 50 healthy subjects. Each iris image has resolution of 2560x1920 pixels.

B. Classification Accuracy

In this section we measure the accuracy of the ILPS algorithms while processing the testing dataset. Results show that while processing testing dataset of lungs patients and healthy subjects, the ILPS was able to identify 44 subjects as having dysfunctional lungs, whereas 49 healthy subjects are correctly identified.

V. CONCLUSION

In this work an Iris based Lungs Pre-diagnostic System is proposed and developed. The proposed system identifies the dysfunctional lungs based on iridology map and machine learning algorithm. The system works in real-time environment and processes the algorithm on CPU-GPU based machine. The results confirm that the system accurately identified the lung problems with an accuracy of 88%.

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