

NAIL BASED DISEASE ANALYSIS AT EARLIER STAGE USING MEDIAN FILTER IN IMAGE PROCESSING

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Abstract - This paper gives idea to predict diseases using the colour of the nail at early stage of diagnosis. The main aim of our project is to analyze the disease without causing harm to humans. In earlier traditional system of disease detection, doctors observe the nails of patients and will predict the disease. Many diseases can be identified by analyzing nails of patients .But it is difficult for human eyes to differentiate the slight changes in colour. So it is less accurate and time consuming .Our proposed system can be quite useful to overcome this issue since it is fully computer based. The input to the proposed system is image of nail which can be captured through web camera. The system will process the nail image and will extract the nail's features to diagnose the disease. Human nail consist of various features, our proposed system uses nail color changes to diagnose the disease. Here, first training set data is prepared from nail images of patients with specific diseases. This training data set is compared with extracted feature from input nail image to obtain the result. In our experiment, we found that training set data are correctly matched with color feature of nail image results. It is focused on the system of image recognition on the basis of color analysis. The proposed system is based on the algorithm which automatically extracts only nails' area from scanned back side of palm (Region of Interest). These selected pixels are processed for further analysis using median filters. The system is fully computer based, so even small discontinuities in color values are observed, and we can detect color changes in the initial stage of disease. By this way, this system is useful in prediction of diseases at their initial stages.

Key Words: Fingernail, nail plate, ESDD (Early Stage Disease Diagnosis).

1. INTRODUCTION

Image processing is a technique in which the image is converted into digital form and performs few operations on the image to extract helpful information. An image is defined as the array of matrix of square pixels which are arranged in rows and columns. Digital image processing has many applications such as face Recognition, signature recognition, medical image processing, military applications, Iris recognition etc. The process of analysing a digital image consists of following phases:

The analysis of nail image includes following steps.

1. **Image Acquisition:** It is the first step in image processing. Commonly this involves pre-processing like scaling etc. The image can be taken as an input through web camera. High resolution images helps in accurate image analysis.
2. **Pre-processing:** In this step, image data is improved to enhance some image features for further processing. Enhancement, restoration, compression are methods of pre-processing.
3. **Segmentation:** In this step, the image is divided into regions for extracting features.
4. **Feature extraction:** This step consists of finding and extracting the features which can be used to determine the meaning of image. The features of an image are various attributes or characteristics of image field. Natural and artificial are the two types of features. Visual appearance of an image is followed in natural while artificial features are result from some manipulations of an image. Natural features includes gray scale textural region, brightness of the region of pixel, edge outline of an object etc. and artificial features includes image amplitude histograms and special frequency spectrum.
5. **Comparison with database:** The generated output from the phase of feature extraction is then compared with the database to diagnose the disease.
6. **Result:** By analysing the result in previous phase disease detection is made.

Many ways are available to identify the disease in human body such as observation of eyes, tongue and nails, pathological, nails and its colour are considered to identify diseases. Nails are the envelope of a fingertip and they are the last to receive oxygen because they are farthest from heart. Due to this, nails are often the first to show signs of disease. The structure of finger nail is shown below:

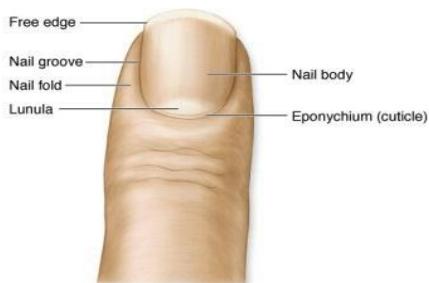


Fig-1: structure of nail

Each finger represents group of organs which are summarized below:

Table -1: Finger name and its related organs

Finger name	Organ
The Thumb	Brain, excretory system and in the reproductive organs
Index Finger	Liver, gall bladder or nervous system
Middle Finger	Heart and circulation
Ring Fingers	Reproductive organs and the hormonal system
Little Finger	Digestive system

2. EXISTING SYSTEM

The segmentation consists of two stages.

Stage I, the color image is converted into gray scale image, and the Contrast-Limited Adaptive Histogram Equalization (CLAHE) is used to enhance the image contrast and the morphological operations are implemented for noise corrections.

Stage II, the blob correction and watershed labeling methods are used for fingernail pattern segmentation. The experimental results show significant effect. There big disadvantage of this system is that blood flow changes can easily identified based on color not from segmentation.

2. PROPOSED SYSTEM

In this paper, we describe the algorithms to find the region of interest from nail image. The proposed system is getting

color feature from the nail image and stored as RGB form. The main aim of this system design is to provide an application in healthcare domain since this is advantageous in terms of cost and time. The proposed system that is being developed is focused on image recognition based on color analysis. In healthcare field, study of human nail has its own significance. Many diseases can be diagnosed by scrutinizing nails of the hand, as human eyes have limitation in distinction in color. This will automatically extract nail area and scrutinize the nail part for disease detection based on color of nail. Here, first training data set is prepared from nail images of patients of specific diseases. For classification average of Red, Green and Blue color is calculated. During matching phase, RGB average is calculated for input image and then matched with training set data. Through this system we can analyze Fungal disease, Allergies, fungal disease, mineral deficiency.

The block diagram of our proposed system is shown below:

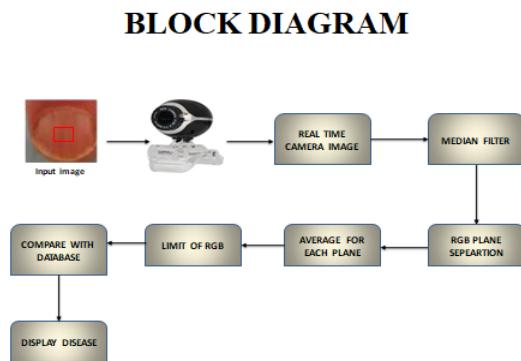


Fig-2: Block diagram of proposed system

The median filter used here is a nonlinear digital filtering technique, which is often used to remove noise from image or signal. Such noise reduction is a typical preprocessing step to improve the results of later processing. The median filter is an algorithm which is useful for the removal of impulse noise (also called as binary noise), which is manifested in a digital image by corruption of captured image with the bright and dark pixels that appears randomly throughout the spatial distribution. Impulse noise usually arises from spikes in the output signal that typically result from external interference or poor sensor configuration. The median filter, when applied to grey scale images, is a neighbourhood brightness-ranking algorithm that works by first placing the brightness values of the pixels from each neighbourhood in ascending order. The median or middle value of this ordered sequence is then selected as the representative brightness value for that neighbourhood. Subsequently, each pixel of the filtered image is defined as the median brightness value of its corresponding neighbourhood in the original image. Median filter is used to remove the speckle noise and salt-and-pepper

noise (impulsive noise). It preserves the edges of an image than other filters.

Example of median filtering application

▪ 3x3 original image:

91	55	90
77	68	95
115	151	210

➤ Median filtering using the full 3x3 neighborhood:

↳ we sort the original image values on the full 3x3 window:

55 , 68 , 77 , 90 , 91 , 95 , 115 , 151 , 210



median value = 91

➤ Median filtering using 5-pixel cross-shaped size:

↳ We sort the original image values on the 3x3 cross window:

55 , 68 , 77 , 95 , 151



median value = 77

Fig-3: Example of Median filtering technique

Support Vector Machine classification is a algorithm used for disease diagnosis. SVM is a most commonly used classification algorithm for disease prediction. It is widely used to predict breast cancer, diabetes, heart disease, lung cancer, etc. It is a supervised learning technique which is used for discovering patterns for classification of data. SVMs were introduced by Vapnik in 1960's for the classification of data. The two elements that are used for the implementation are mathematical programming and kernel functions. The kernel function allows it to search for variety of hypothesis spaces. In SVM, the classification is performed by drawing the hyperplanes . In two class classification, the hyperplane is equidistant from both the classes. The data instances that are used to define this hyperplane are known as the support vector. A margin defined in SVM is the distance between hyperplane and the nearest support vector. For good separation by this hyperplane, the distance of margin should be as large as possible because large distance gives less errors. If margin is close, then it is more sensitive to noise.

The equation is to define the hyperplane and the margin are $= 0$ and $= \pm 1$ respectively. Here, is defined as a weight vector and as bias. To get the appropriate results of SVM, the input features given to SVM are needed to be reduced. That reduced feature set helps to improve the efficiency of the results produced by the algorithm. The useful features alone are selected from the entire set of features for reducing the features set. In feature selection, there is a set of features and the method is used to select the subset of features that can perform best under the classification system. The term 'feature selection' refers to the algorithms which gives a subset of feature set that are given as an input to the algorithm. The three main approaches of feature selection are filter, wrapper, and embedded. In Filter methods, the high ranked features selected on the basis of a statistical

score. In embedded and wrapper methods, classifier design is considered to get the subset of features. These techniques are helpful to efficiently and easily extract the features for Support Vector Machines.

For better results of SVM, the features that are given as an input to SVM need to be reduced. To reduce features set, only the useful features are selected from the entire set of features. This paper gives comparison of the various feature extraction techniques like F-Score, Genetic Algorithm, K-means, ReliefF and SVM-RFE in terms of accuracy achieved by them in order to predict the tumor in breast diagnosis. SVM-RFE helps to achieve highest accuracy of 97% and K-means being the simplest method will help to achieve the accuracy of 96%. So, it is beneficiary to use any of these two methods to extract features for breast cancer diagnosis. Our future work is to study various enhancements of K-means and then use the best enhancement, in terms of performance, as feature extraction method.

4. LITERATURE SURVEY

A review on various researches and related work based on nail image analysis for several disease detection are given below

1)Vipra Sharma (2015) proposed system for disease detection by analysing finger nail colour and texture takes back side of palm region and then segment the image. The segmented image is the actual nail region. They have analysed the nail colour and texture and compare these values with the predefined values for healthy nails and diagnose the result. For this experiment they only processed the image having format BMP, GIF, JPEG, PNG, TIFF etc.

2) Hardik Pandit (2013) proposed the model of nail colour analysis. In this experiment they scan back side of human palm then extract nail region from cropped image of palm by RGB component analysis in which algorithm was designed which gives average as well as pixel by pixel nail colour for each finger. For the comparison they took 50 reference images per colour. After calculating arithmetic mean they fixed a reference colour. For the identification of stage of a disease they fixed a percentage of pixels with given colour in all nails.

3) Sujath R (2017) proposed leaf disease detection. In this experiment, the input image is first converted from RGB to HSI and then they perform k-means clustering algorithm and Support vector machine which is statistical learning based solver for accurate detection of leaf disease.

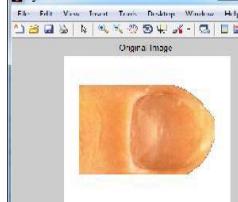
Table 2: Diseases based on nail color and shape

S. no	Nail Type	Image	Possible Diseases
1	Bluish Nails		i. Heart problems ii. Emphysema
2	Pale Nails		i. Anemia Congestive heart failure ii. Liver disease iii. Malnutrition
3	Yellow Nails		i. Lung disease ii. Diabetes or psoriasis iii. Thyroid disease
4	Dark Lines Beneath the Nail		i. Melanoma (dangerous type of skin cancer)
5	White Nails		i. Jaundice ii. liver trouble iii. Anemia.
6	Terry's lines		i. Hepatic failure ii. Cirrhosis iii. Diabetes iv. Mellitus v. Congestive Heart failure vi. Hyperthyroidism
7	Beau's Lines		i. Systematic disease

4) Nityash Bajpai (2015) Proposed automated prediction system for various health conditions by analysing human palm and nails in which human palms are scanned from both sides, ROI is captured by extracting features. They worked on symbols presented on palm and colour of human nails for prediction of disease. For identifying the symbols on human palm they have used some neural network back propagation algorithm which brings 90%-95% efficiency of disease prediction system. For the nail image processing they have used Back Truncation Code and produced either Training Vector or Image vector and by using similarity measures they have produced result. For palm Image processing first they converted RGB colour to Gray scale Image then applied Frichen edge detection algorithm on palm images.

Morphological techniques such as Dilation and Erosion applied to smooth image , then by analysing principal component, they have produced vectors and by applying similarity measures the result was generated.

Table-3: Disease Detection

S.no	Original Input Image	Disease Output	Prediction
1			Nail Affected By Hangnail Disease
2			Nail Affected by Red Lunula Disease

5. CONCLUSION

Health is a critical aspect for Human life. Identification of human health conditions and accurately predicting the symptoms of the diseases is useful work for the society. For these a new system is designed based on Digital Image Processing, medical palmistry and nail-color analysis. Nail colors are used for the disease detection. It helps in recognizing disease of the person and minimizes the cost of the diagnosis of diseases. This detection system makes easy for doctors to give correct treatment to patients. Using this algorithm the computer system would be able to predict some specific diseases which could be identified by observing nails. Hence, this system can be useful in healthcare domain, especially in routine checkups. So, the diseases could be able to get caught in their initial stages. Our future enhancement is to implement this project with hardware setup to overcome some limitations of image processing.

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