Finger Nail Analysis to Diagnosis the Disease – A Study

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Abstract--Medical image processing is a vast and prominent area where medical practitioners will be assisted to diagnose patient's disease. In medical science, color and texture of the nail is carefully observed by doctors to get key idea about health of the patient. Nail growth is affected by disease, nutrition, medications, trauma, chronic illness, fever and the aging process. In this paper finger nail is considered to diagnose the current health conditions of the patient. Variation in colors, shape and texture of nail specify certain diseases. Human eye has limitation in recognising the colors, shape and texture and hence Digital Image Processing techniques can be used to analyze the nail status for diagnosing the health of human.

Keywords—Finger Nail, Region-based Segmentation, Structure of Nail, Matlab. Nail disease.

I. INTRODUCTION

The field of medical science is extensively emerging. There are so many techniques which assist medical practitioners to diagnose patient's disease. One of these techniques is fingernail colour analysis. Transformation in nail colour and texture may indicate that the condition of health is abnormal. The primary role of fingernails is to guard the fingers. However, the fingernails are also an important sign of current health; transformation in fingernails may divulge previously unnoticed medical conditions. The shape, texture, and colour of natural nails act as a window into human body, and while some nail symptoms are harmless, others can be indicative of chronic diseases, including cancer [1]. The change in the fingernails alert us the conditions like malnutrition, diabetes, iron deficiency, and diseases related to the organs like liver and heart.

A. Structure of Finger Nail

Nails grow from cells that multiply within the plinth of the nail. The strength, thickness, growth rate, shape, color and texture of nails are characteristics used to diagnose the health condition of the human.

The structures of the nail (figure 1)

- Nail matrix – nail growth occurs.
- Nail plate – the noticeable part of the nail.
- Nail bed – the nail assembles on top of the nail bed.
- Lunula – the crescent-moon contour seen at the plinth of the nail plate.
- Nail folds – the meager skin furrows which hold the nail plate.
- Cuticle – the flutter of thin hankie over the plinth of the nail plate.

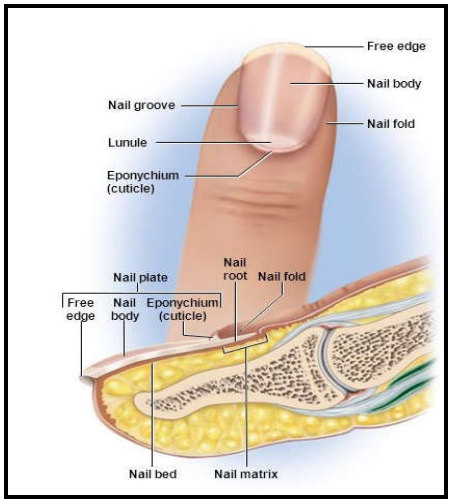

Figure 1. Structure of Finger Nail [2]

The rest of the paper is organized as follows: Section II surveys the papers related to nail disease diagnosis and segmentation techniques. The proposed method is described in Sections III and IV. Section V demonstrates the experimental results and provides the overview of the symptoms and diseases of the patient by diagnosing the nail color and texture and the paper is concluded in section VI

II. RELATED WORK

Vipra Sharma et al[3] studied the color and texture of nail and detected the diseases by comparing these values with the predefined value of healthy nail. The nail color and texture is extracted by applying image segmentation and the analysis is carried out in the segmented area to detect whether the body is healthy or not. Trupti S Indi et al[4] analyzed the human's hand nail for diagnosing diseases at early stage. The nail color change is used for diagnosis purpose. Using Weka tool, the training data set is prepared from the nail images of patients of particular disease. The disease is diagnosed by comparing the extracted feature with the training data set. The results showed that the color feature of nail image is suitably matched with the training data set. HardikPandit et al[5] discussed the analysis of nail color model to predict the diseases. In this model, human palm nail color is observed for the prediction of probable diseases. The performance of the model provides accurate results and it overcomes the limit ations of human eye like subjectivity and resolution power.

SukdeepKaur et al[6] discussed the various image segmentation techniques such as threshold segmentation, point transformation, watershed transformation and wavelet transform. The analysis revealed that the logarithm operator method in point transformation compressed an image by replacing each pixel value with its logarithm. The two merged objects can be separated using watershed transformation. The wavelet transform technique is used to analyze horizontal, vertical and diagonal views of two dimensional images.

Nida M Zaitoun et al[7] presented a comparative study of block-based image segmentation techniques such as region-based and edge or boundary-based methods. Muhammad[8] discussed and considered various important image segmentation techniques which are used for the purpose of image processing. It is analyzed that there is no ideal method for image segmentation since the image segmentation process depends on various factors such as pixel, color, texture and intensity, similarity of images, image content and problem domain. However, hybrid solution provides better solution for image segmentation problem. Nityash Bajpai et al[9] proposed a new Disease Detection System(DDS). Using this proposed DDS, the users can predict the diseases in human body with the help of user's palm and nail. The prediction is done by observing the palm and nail's characteristics such as color and texture.

The above survey reveals that the nail color, shape and texture plays a vital role in early prediction of diseases. In this paper finger nail is considered for analysis. Initially the finger nail image is extracted from the finger and compared with the healthy nail image. If any deviation then it can be concluded that the patient is not healthy.

III. PROPOSED METHOD

Medical test or pathological test requires the patient should be present physically. But with medical image processing the image of the patient is sufficient for diagnosis of the diseases. In proposed method, the finger nail is considered for analysis. The steps required to examine the nail condition is as follows.[figure 2.]

- Read the input images.
- Extract the nail to be examined.
- Train the nail images.
- Analyse the feature of the nail.
- Compare the color and texture with predefined images.

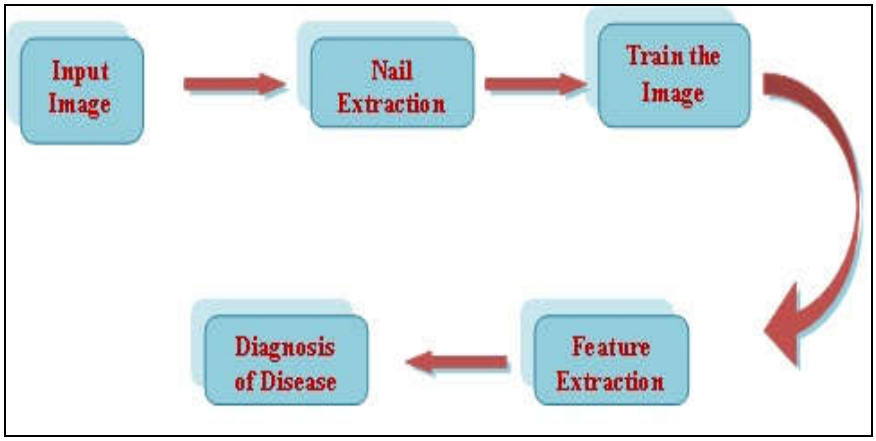

Figure 2. Diagnosis of disease using Finger nail images

IV. Working of the Model

Step 1:

The finger/fingers image of the human is taken through digital camera or the image can be scanned through a scanner and considered as the input image.

Step 2:

After the finger image is read, the nail has to be segmented using segmentation technique. Segmentation is the process of sub dividing the image into constituent parts until the object of interest in the application have been identified and isolated. In the proposed method, region based segmentation is used to segment the nail. Region based segmentation classifies an image into a number of regions or classes. For each pixel in the image it will be decided or estimated to which class it belongs to. There are a variety of approaches to perform region based segmentation. Since the emphasis of this paper lies on identifying the nail boundary it does not matter which method is being used to get the region classified image as long as the output of that method gives reasonable results.

Step 3:

After extracting the nail, the color, shape and texture of the nail should be identified and compared with the healthy nail. If any deviation from the healthy nail, it can be concluded that the patient is not healthy.

V. Expermental Results

The finger image of the patient is given as the input and the nail is segmented and shown in figures 3 a-c. The experimental analysis is done in matlab[10].

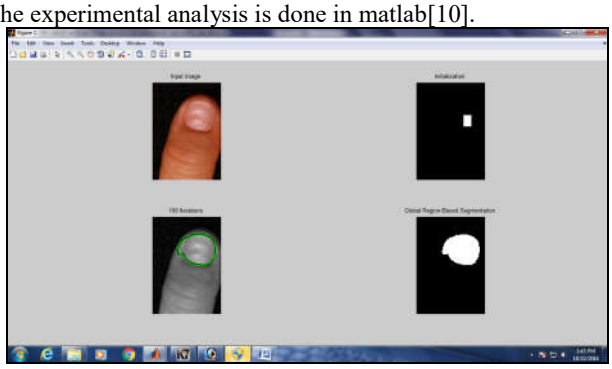

Figure 3a

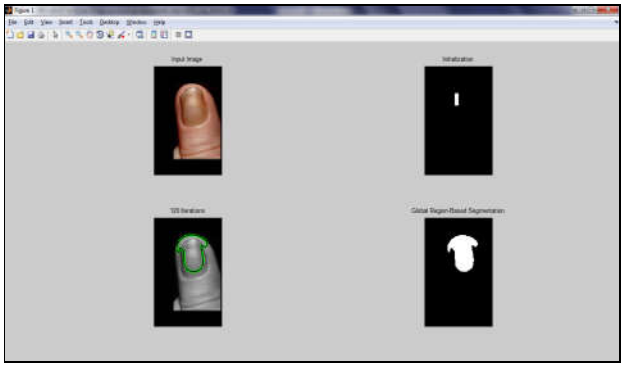

Figure 3b

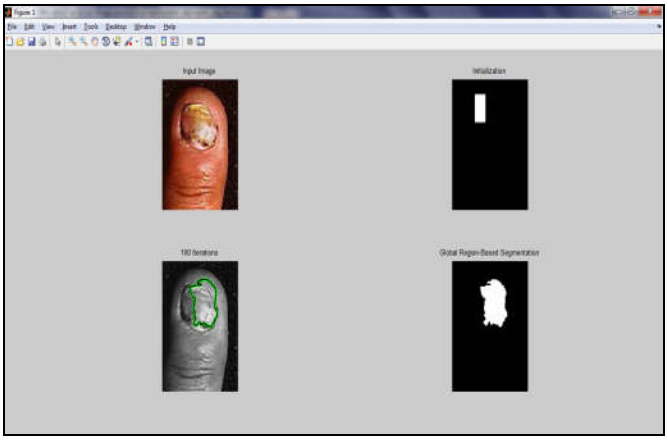

Figure 3c

The Table 1 in Appendix provides an overview of the diseases affected by the patient by diagnosing the color and texture of the finger nail. It provides the status of the nail, diseased nail image, medical term of the disease, symptoms and diagnosis. If no variation from the healthy nail is found then the system concludes that the patient is healthy.

VI CONCLUSION

This paper deals with the finger nail analysis, in which the color, shape and texture plays a vital role in diagnosing the patients health status. The proposed method extracts the nail from the finger and compares the segmented nail with the healthy nail. If it finds any deviation in color, shape or texture, then the patient can be concluded that he is unhealthy. In future RGB model can be used to identify the color of the nail and identify the disease for the further treatment.

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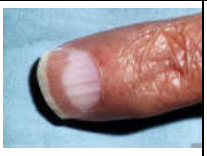
APPENDIX

TABLE 1 SUMMARY OF NAIL COLOR AND TEXTURE ANALYSIS

Nail Status	Image	Medical Term	Symptoms	Diagnosis
Redness around The Nails		Paronychia	throbbing pain, redness, warmth and swelling	Diabetes
Terry's Nails		Paronychia	wrinkles around the nails, abnormal shine, look like an aged person	▪ Diabetes ▪ Organ failure ▪ Liver cirrhosis ▪ Hyperthyroidism ▪ Renal failure ▪ Liver cirrhosis ▪ Congestive heart failure ▪ Malnutrition ▪ Thyroid problem
Thick and Overgrown Nails		Onychogryphosis	grow at a faster pace than they normally do	Arthritis or psoriasis
Dark Vertical Stripes along the Nail		Melanonychia	dark stripes that emerge along their nails	Indicate a form of skin cancer
Small Depressions or Dents on the Surface of the Nails		Leukonychia	Dents appear on the nail surface	Psoriasis or eczema
Discolored Nails		Onychodystrophy	Shift their color from a natural, healthy pink to green.	psoriasis or a severe fungal nail infection, jaundice, tuberculosis, sinusitis, lymphedema or even chronic paronychia.
		Onychodystrophy	grey nails	Usually triggered by various prescription drugs such as antimalarial.
		Melanonychia	brown nails	Malnutrition or even thyroid disease.
		Leukonychia	half brown and half white	liver failure, kidney failure

		azure lunula	Yellow Nail	fungal nail infection
		cyanosis	Blue Nail Base	Iron deficiency
Spoon Nails		Koilonychia	nails are excessively soft and look scooped out	Hemochromatosis, (liver problem), heart disease and anemia
Frail And Brittle Nails		Onychoschizia	crumble or to become thin, frail and brittle	lack of vitamins nail psoriasis, thyroid problems or fungal nail infections
White Stripes on the Nails		Leukonychia	dark-colored stripes along your nails	lack of proteins
Curved Nails (nail clubbing)		Onychogryphosis	lack of oxygen	IBS and lung disease to liver disease, cardiovascular problems and even AIDS