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International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Simple Approach for Early Disease Detection through Processing of Human Nail Images

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DOI: https://doi.org/10.55248/gengpi.4.623.46501

A B S T R A C T

From the concept of medical science, a wide range of systemic and dermatological disease can be predicted from the human nails by observing the color and shape of human nails. A white spot here, a rosy stain there, or some winkler projection may be an indication of disease in the body. Abnormalities started in the liver, lungs, and heart can show up in the nails. Doctors observe the nails of patients to get assistance in disease identification. A serious issue with the people in rural area is that they don't take care about the nail disease. Even it is also seen that sometimes doctor is not available for consultation purpose or patient is not available physically. The main objective of our work is to predict nail diseases mainly by observing color of human nails. The sorts of diseases can be recognized based on the color and texture of the nails (for example, bluish nails signal heart problems), and the early stages of diseases are recognized and diagnosed using image processing and convolutional neural networks. The input to the proposed system is the human nail image. The training data set is used to compare a feature retrieved from the input nail image. In this work, we discovered that the nail image's color feature matches the training set data accurately. The suggested system directs decision-making regarding disease diagnosis in such a situation. The proposed method will aid medical professionals in the early detection of ailments.

Keywords: *digital image processing, early disease prediction, nail image, nail colors, feature analysis*

1. Main text

The colour and shape of a person's nails can be used to anticipate numerous disorders in the healthcare industry. An indicator of a sickness in the body could be a white spot here, a pink stain there, or some winkler projections. Our nails may display signs of liver, lungs, or heart issues. In order to aid in the diagnosis of diseases, doctors look at the nails of their patients. The major goal is to use the colour of human nails to forecast a variety of ailments. Convolutional neural networks will be used to categorise and process the types of diseases that can be determined by the colour and texture of the nails (for example, bluish nails suggest heart problems), and image processing will be used to identify and diagnose diseases in their early stages [1-3]

The issue is that many patients in various locations, such as rural areas, do not take care of the nail disease because the doctor cannot be reached for a consultation or the patient cannot be reached physically. Therefore, the doctor can confirm the diagnosis simply by receiving the patient's nail image results [4-6]

Human nails can be examined to look for specific disorders that affect the body. For the purpose of using your images, diagnosing nail illnesses, performing additional tests, and getting a scan, the nails are a component of the body where we may make a diagnosis.

❖ Even though the patient was not required to be present for the test, all that was needed was an image of the patient's hand, which was simple to get and quick to complete.

❖ The programmes are reasonably easy to operate with because AI algorithms have not been deployed. Even if the accuracy might not be extremely accurate, it might be a valuable tool for identifying nail infections. [7-10]

The ability of the human eye to distinguish between colours is limited, and some people additionally struggle with issues like colour blindness. A computer can classify more than 16 million colours with ease. Therefore, using a computer to analyse nail colour is a better method than using your eyes.

- This technology is specifically made to meet the needs of low-wage workers, farmers, labourers in the agricultural and fishing industries, construction workers, etc. who want inexpensive diagnostics. This is why it might be an excellent substitute for expensive machinery in rural regions as well.
- Pathological tests are difficult, uncomfortable, pricey, and invasive; patients must be available for them before they may be used as an alternative diagnostic tool.

- Since the doctor can confirm the diagnosis and issue the proper prescription for the disease being diagnosed simply by receiving the patient's nail image results, this system is also helpful for patients when the doctor is unavailable for consultation purposes or the patient is not physically available.

In a human being, various systemic and dermatological diseases can be easily diagnosed through careful examination of nails of both hand and legs. A lot of nail diseases have been found to be early signs of various underlying systemic diseases. The color, texture or shape changes in nails are symptoms of various diseases primarily affecting nails. And if we are able to use digital image processing techniques for detecting such changes in the human nail, then we would be able to get more accurate results and predict various diseases easily. The Proposed system (NIPS-K) extracts around 13 features of the human nail which is a combination of Nail Color, Shape and Texture Features and then they are used for disease prediction. The input to the system is the backside of the palm which is captured using a camera. Then the Region of Interest, the nail area is segmented automatically. The segmented nail area is then processed for extracting the features of nail. The extracted features are then combined to form a feature vector which are then compared with the existing datasets and the diseases are predicted using the knowledge base. Thus the proposed system will assist us in detecting various diseases in their early stage itself easily without spending much of our time and money. [11-14]

A survey on various research works on nail image analysis for disease detection and similar techniques used in early detection of nail disease detection is given below, • Matthew Burnette et al [1] worked to detect the nutrition elements in human nails using micro plasma-induced breakdown spectroscopy with a clustering algorithm using Image processing; it had poor detection. • Trupti S. Indi et al [3] wrote a paper on the human nail image analysis method for early disease diagnosis with a colour detection algorithm, but it had a slow detection. • Sneha Gandhat [4] proposed an algorithm which automatically extract nail area and scrutinize this nail part for disease detection based on color of nail, proposed system requires only the image of patients' hand that can be obtained easily and it's not difficult to perform. This can be used in healthcare domain to predict diseases like Diabetes & Jaundice from nails for human being. [15-16]

Diseases	**Causes**
White nails	Jaundice , liver trouble, anemia
Bluish nails	Heart problems, Emphysema
Koilonychia	Iron deficiency anemia
Half and half nails	Chronic kidney disease, may also occur in Crohn's disease, Behçet's disease, pellagra citrullinemia, Kawasaki disease
Nail clubbing	Lung cancer, Cystic fibrosis, Cirrhosis, Grave's disease
Terry's lines	Hepatic failure, Diabetes Mellitus, Congestive heart failure, Hyperthyroidism
Dark lines beneath the nails	Melanoma (dangerous type of skin cancer)

A healthy human mostly has smooth, pink, and shiny nails. Each finger represents a group of the organs listed below:

The Thumb	Brain,excretory system and reproductive system
Index Finger	Liver,gall bladder or nervous system
Middle Finger	Heart and circulatory system
Ring Finger	Reproductive and the hormonal system
Little Finger	Digestive system

2. Methodology

Now days, non-invasive procedure for disease diagnosis is an important aspect in healthcare domain. Various diseases can be diagnosed by noninvasive approach, nail image analysis. The different nail features like nail color, nail shape and nail texture used to analyze nail image. The nail features are extracted and measured by deriving these features in certain terms of area of nail shape, perimeter of nail shape etc.

Our work follows the given steps which combine three major segments starting from image as input and image as output. The three major sections are Interface for input, training of datasets, prediction from images after analysis. The techniques from image processing operations are used for the test datasets and the training datasets. Evaluation in first phase is carried out maintaining DI algorithm.

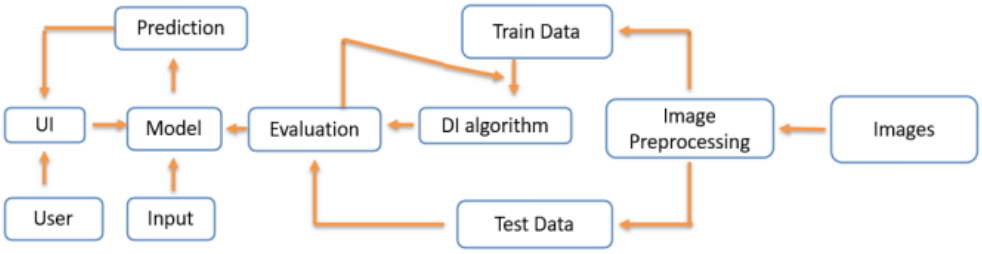
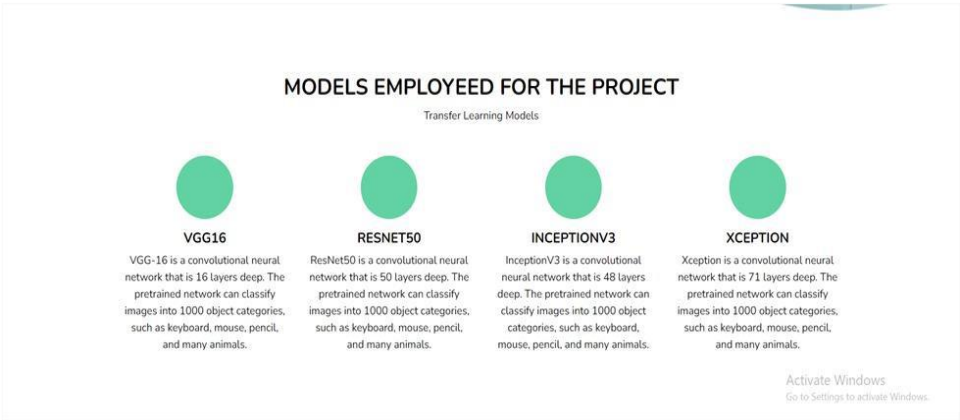


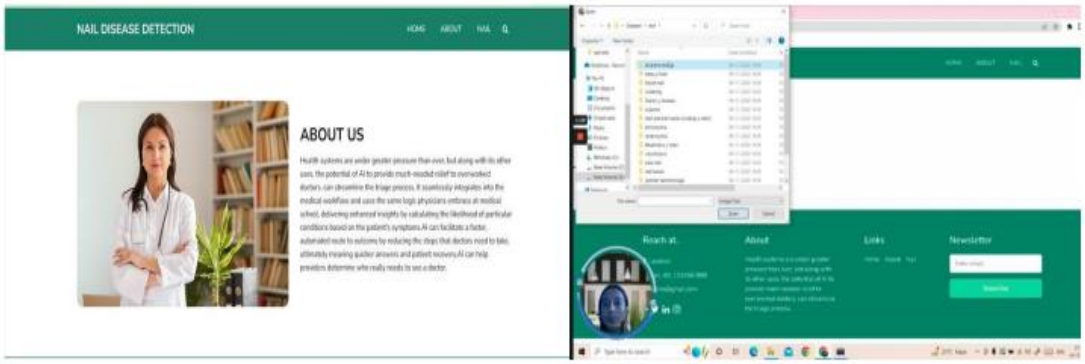
Fig. 1 - sequences representing work flow.

3. Results

Computer can easily classify more than 16 million colors; whereas human eye capability has limitations while identifying colors and also some people face the problem such as color-blindness. So, using a computer based system or algorithm to analyze nail color is a better method than using our eyes.

This technology is uniquely designed to cater for the Blue collar workers, farmers, laborers in agriculture and fisheries, construction workers etc. who desire& deserve cheap and affordable diagnosis. This is why it can be a good alternative to high cost machinery for the rural areas too. Pathological tests are complex, painful, expensive & invasive. It also requires patient to be available for pathological test so this can be as an alternate diagnostic tool. This system is also helpful for the patient when the doctor is not available for consultation purpose or patient is not available physically therefore just by receiving patient's nail image results the doctor can confirm the diagnosis and write appropriate prescription for the disease that is being diagnosed.





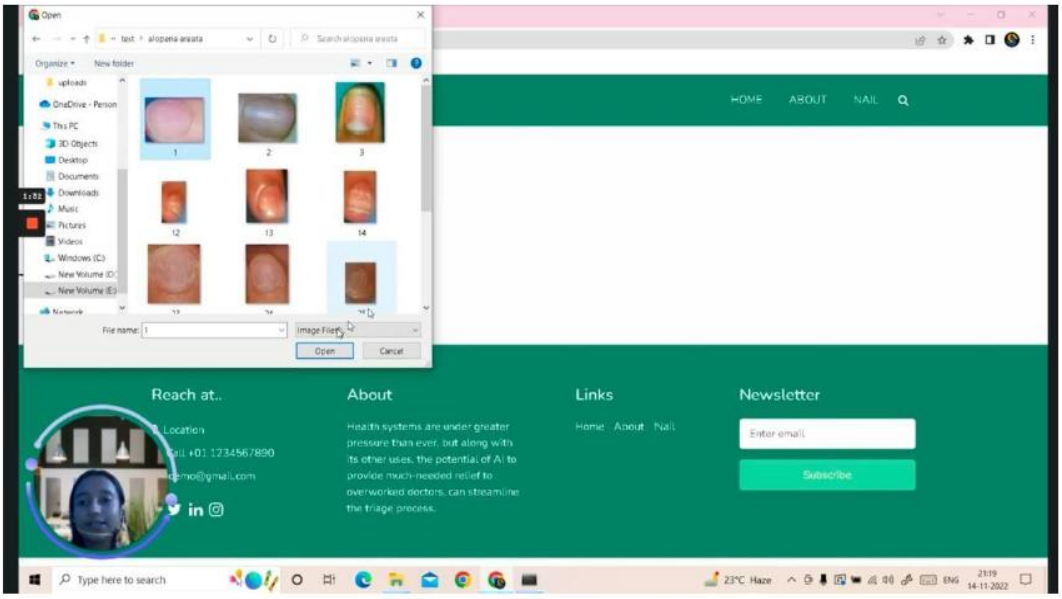


Fig. 2- output of our system.

4. Conclusion

For the sake of society, it is very helpful to be able to identify many diseases in their early stages. Because changes in nail are early indications of numerous diseases, medical professionals have been using nail color, shape, and texture changes to forecast various diseases. Doctors will undoubtedly benefit from the suggested model's automatic, convenient, economical, and accurate disease prediction capabilities. The system that we have developed by using fundamentals of advanced machine learning is less time consuming, cost efficient, easy to implement, accessible to common people even in remote areas where doctors with specializations are not available, helpful for people in early detection as advanced diagnostic tests for these diseases are only available in metro cities, able to predict the starting stage of disease, can save time, can be analyzed at homes, can save the cost of treatment & burden of health insurance. The detection system makes it simple for doctors to provide patients with the right care.

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