Early Stage disease Diagnosis Using Human Nail in image Processing

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INTRODUCTION

- Diseases can be predicted by observing color of human nails.
- Doctors observe nails of patient to get assistance in diseases identification .
- The need of system to analyze nails for diseases prediction is because human eye is having subjectivity about colors, having limitation in resolution and small amount of color change in few pixels on nail would not be highlighted to human eyes which may lead to wrong result where as computer recognizes small color changes on nail.
- The proposed system will extract color feature of human nail image for disease prediction.
- The system is focusing on image recognition on the basis of human nail color analysis.

- Many diseases could be identified by analyzing nails of human hands.
- In this system human nail image is captured using camera.
- Captured image is uploaded to our system and region of interest from nail area is selected from uploaded image manually.
- Selected area is then processed further for extracting features of nail such as color of nail.
- This color feature of nail is matched using simple matcher algorithm for diseases prediction .
- The system is useful in prediction of diseases in their initial stages.

LITERATURE SURVEY

YEAR OF PUBLISH	AUTHOR NAME	TITLE OF THE PAPER	MERITS	DEMERITS
2016	Trupti S.Indi, Yogesh A.Gunge	Study of Nail Unit using Image Processing Methods. **Link:**https://www.researchgate.net/publication/308851472_Study_of_nail_unit_using_image_processing_methods	1) It can work for low resolution images, no special sensors /devices are required. 2) It considers nail plate appearance only and complexity is less	1) It gives high accuracy when fusion with other metrics only, fusion is still an issue. 2) Acceptability is an issue and retrieving nail matrix feature is challengeable.
2016	H.Pandit Dr.Shah	A system for nail color analysis in healthcare. **Link:**https://www.researchgate.net/publication/261434138_A_system_for_nail_color_analysis_in_healthcare	1) Reduces complexity and produces better accuracy in matching. 2) The system is computer based ,so small discontinuities in color values are observed.	1) The nail fold shadows or fungus may cause mismatching without accurate result. 2) It doesn't consider additional traits for clear results.
2017	Shih-Hsiung Lee, Chu-Sing Yang, Ting-Wei Hou, Chein-Hui Yeh	An image preprocessing method for human nail segmentation. **Link:**https://www.researchgate.net/publication/321401514_An_image_preprocessing_method_for_fingernail_segmentation_in_microscopy_image	1) In order to maintain the nail image quality, this paper uses microscope to capture nail image and the effect is significant. 2)It provides a history of drugs intake ,toxin level and chemical effects that represents a unique substrate for forensic	1) Fusion at feature level is still an issue in high complexity in image processing. 2) Though very simple method the points should be sticked exactly on the nail plate.

YEAR OF PUBLISH	AUTHOR NAME	TITLE OF THE PAPER	MERITS	DEMERITS
2017	Shih-Hsiung Lee, Chu-Sing Yang, Ting-Wei Hou, Chein-Hui Yeh	An image preprocessing method for fingernail segmentation in microscopy image. **Link:** https://doi.org/10.1109/SIPROCESS.2017.8124590	1) This paper proposes an image preprocessing method, trying to segment different parts of nail and provides significant effect. 2)It can be used in medical diagnostic system, biometric authentication or other biometric application.	1) One of the main drawbacks in biometric system is imposter attacks, that is people leave their palm/fingerprint whenever they touch an object and thus making a way of spoofing. 2) Full nail plate cannot be used for authentication of the growth of nail plates.
2018	MaliSupriya Bhupal , KoreReshma Ananda, PatilPoonam Bhimrao , MujawarSaniya Yunus , A.A.Salunkhe.	Disease diagnosis system by human nail image processing. **Link:** http://data.conferenceworld.in/NMCOE18/5.pdf	1) System design is to provide an application for use in health care domain this is advantageous in terms of cost and time. 2) This model gives accurate results than human vision and used as additional metric in multi model type.	1) Patterns of nail are not used for classifying the diseases. 2) Artificial marks on nail may not give accurate result.
2019	Dr. Nithya1, S. Masil Asha, Rupasree Kurapati, Buggareddy Shanmukha Priya, D.Divya.	Nail based diseases analysis at earlier stage using median filter in image processing. **Link:https://www.irjet.net/archives/V6/i3/IRJET-V6I3511.pdf**	1) Nonlinear digital filtering technique used to remove noise from image or signal for better result. 2)In presented system, system analyses the human nail and gives probable disease for person including health case.	1) The blood flow changes can easily identified based on color not from segmentation. 2) There is limitation in image processing.

PROBLEM STATEMENT

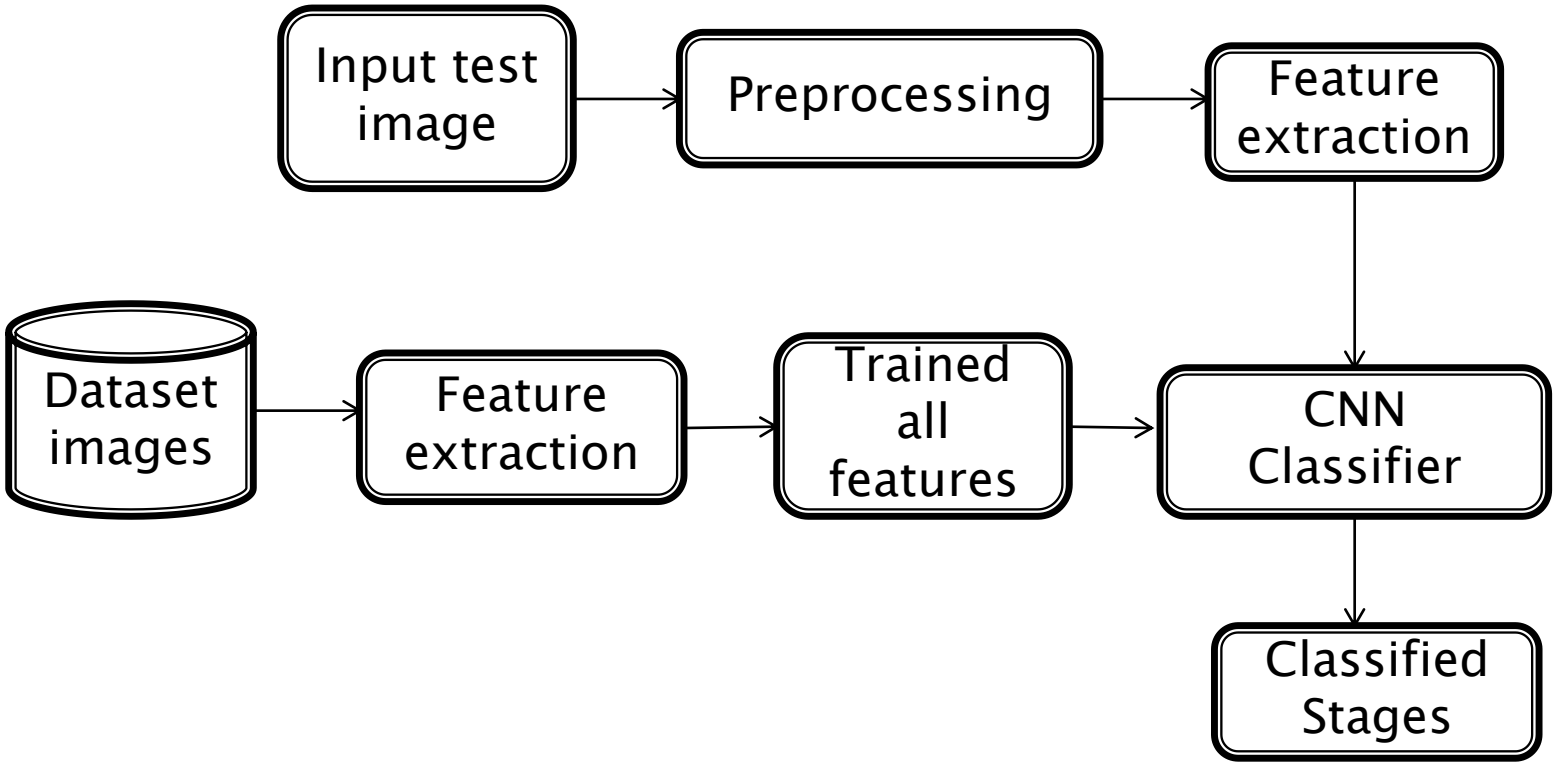
- Human nail can be used for the prediction of various systemic and dermatological diseases.
- The proposed system – Nail Image Processing System helps us to create a model which can perform the analysis of human nail and thereby help us in predicting various diseases .
- Common signs that may be noticeable around the nail are discoloration of nail to black, white, yellow or green, thickening of nail, dry or scaly skin around the nail.
- This project contend a deep convolutional network to classify diseases from images.

- This work has been tested on our dataset and it results in great performance in feature extraction .
- This proposed system will help the doctors in the early diagnosis of diseases.

TECHNOLOGY STACK

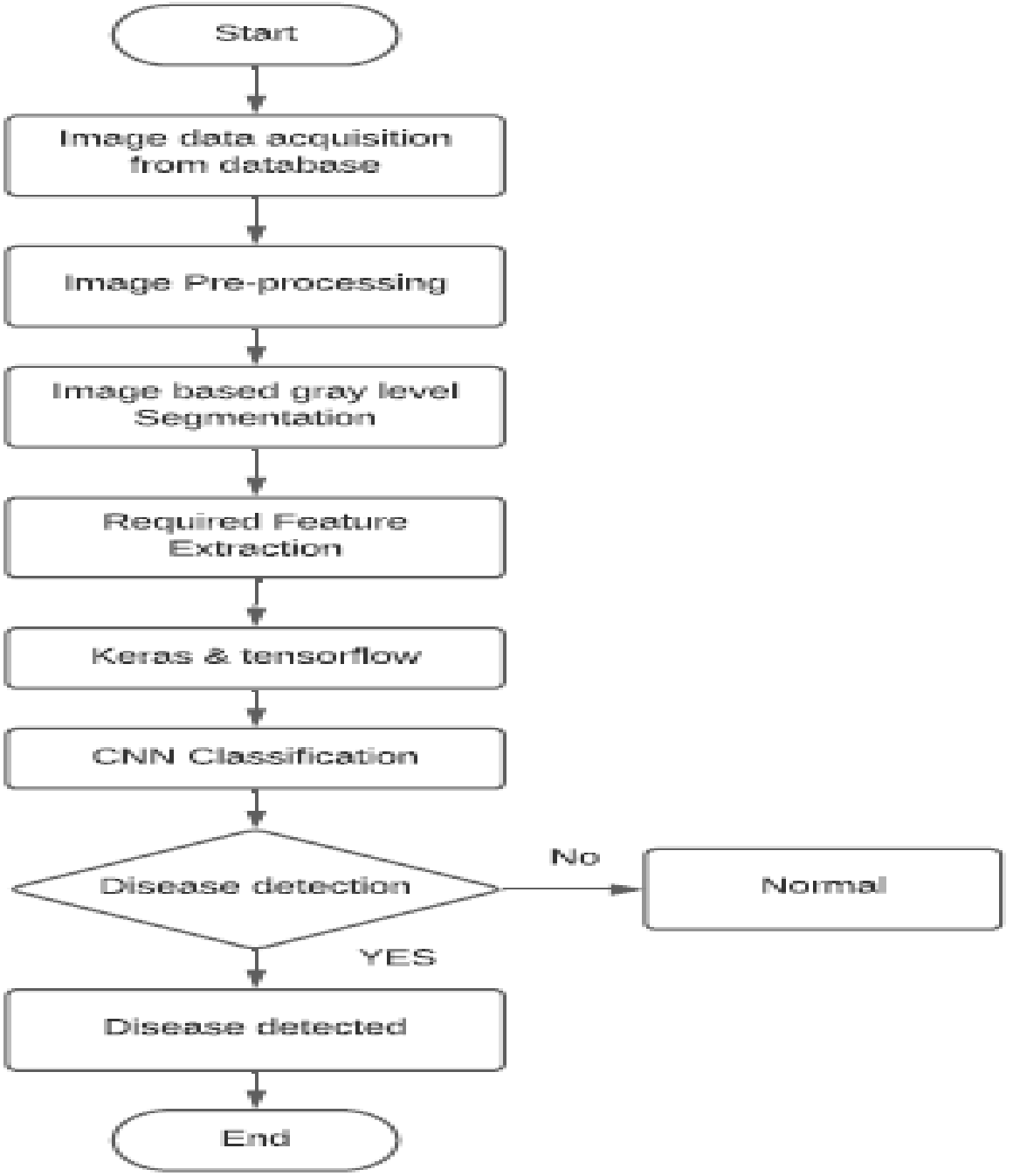
- DOMAIN :Deep Learning
- FRONT END: Python Idle
- BACK END: Tensor Flow
- LIBRARIES: Open CV

SYSTEM ARCHITECTURE

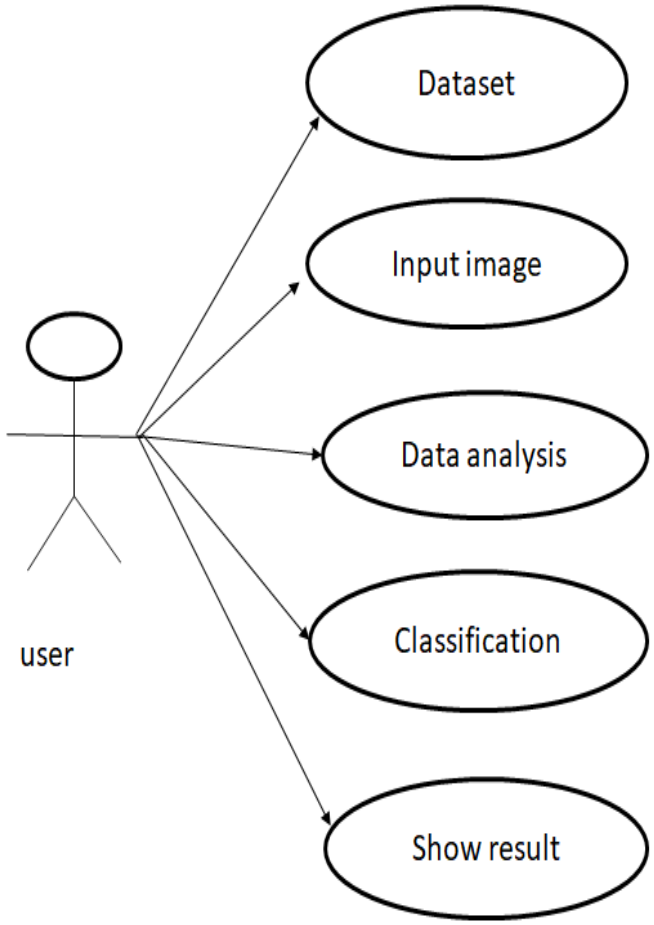


SYSTEM DESIGN

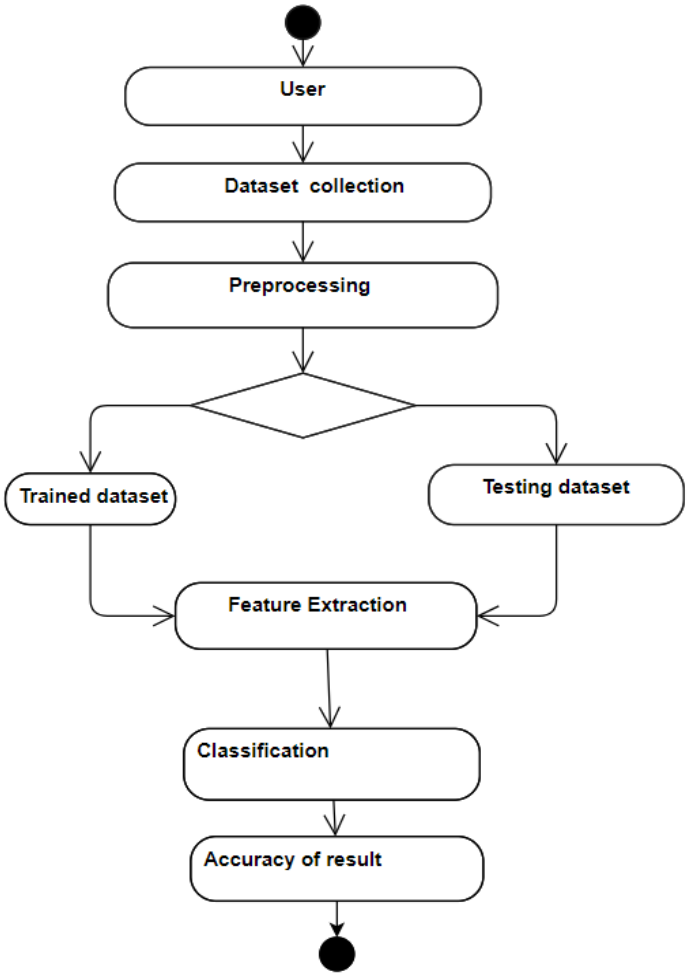
a)Flow diagram



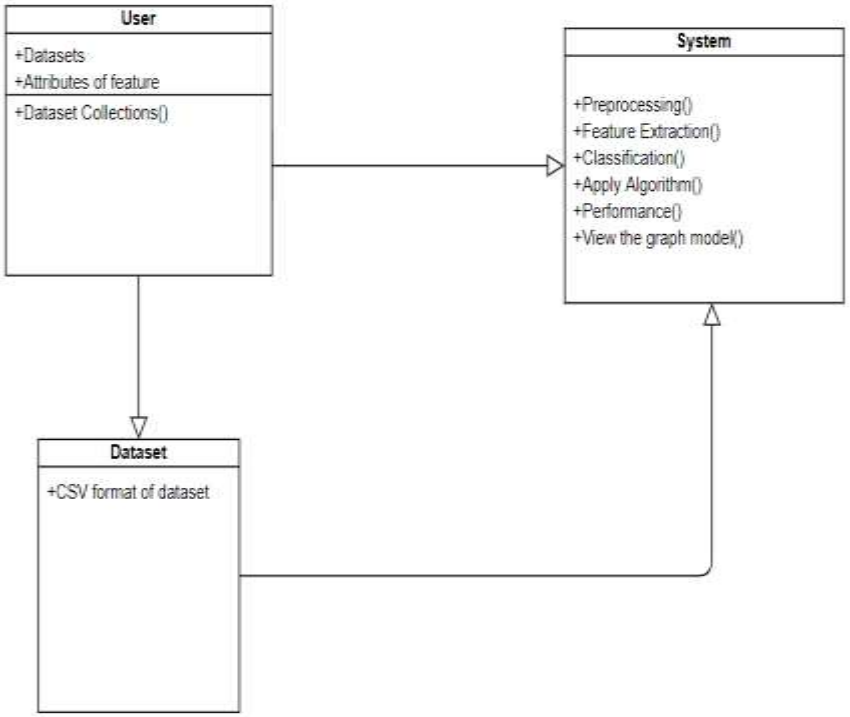
B)USE CASE DIAGRAM



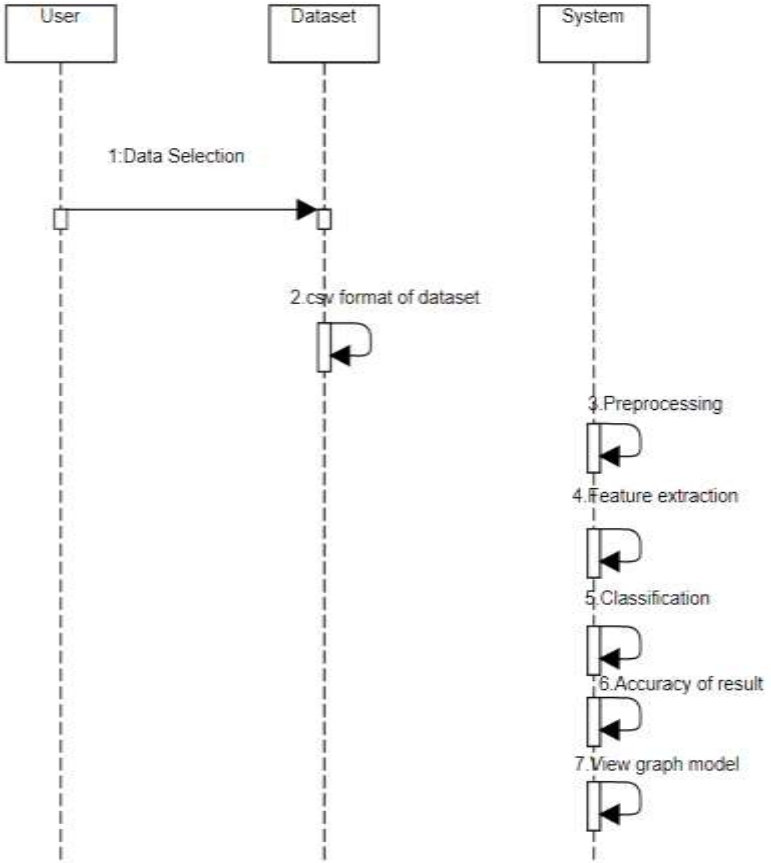
c)ACTIVITY DIAGRAM



D)CLASS DIAGRAM



E)SEQUENCE DIAGRAM



MODULES

- Image acquisition
- Pre-processing
- Data Labelling
- Feature analysis
- Convolutional Neural Network

Module Description:

Image Acquisition

- Image acquisition in image processing is collection of dataset.
- It is the action of retrieving both normal and abnormal nail image for further analysis.
- Datasets are collected from kaggle website.

Pre-processing

- Image pre-processing is the term for operation on images at lowest level of operation.
- The human nail image is given as input to the pre-processor.
- If the image are of poor contrast , the pre-processor will enhance the contrast for clear classification type.

Steps Involved:

- Acquire the dataset
- Resizing
- Conversion
- Filtering

Data Labelling

The steps followed in data Labelling are:

- Labelling
- Assigning Classes
- Allocating Index
- Setting the Path

Feature analysis

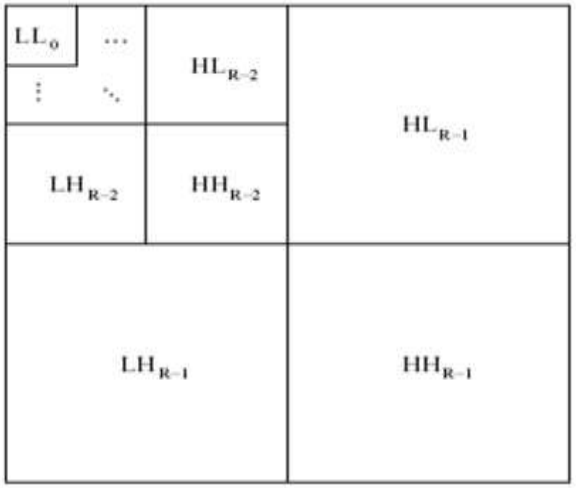
Feature analysis consists of:

- DWT (Discrete Wavelet Transform)

DWT

- Discrete Wavelet Transform is used in lossless image compression of gray level image.
- High quality images that require large storage are to be compressed.
- DWT transforms a discrete signal . L represent the low-pass filtered signal L(low frequency)allows the perfect reconstruction of original Image.

DWT Structure



LL: Horizontal Low pass & Vertical Low pass

LH: Horizontal Low pass & Vertical High pass

HL: Horizontal High pass & Vertical Low pass

HH: Horizontal High pass & Vertical High pass

STEPS

1. Digitize the source image into signal.

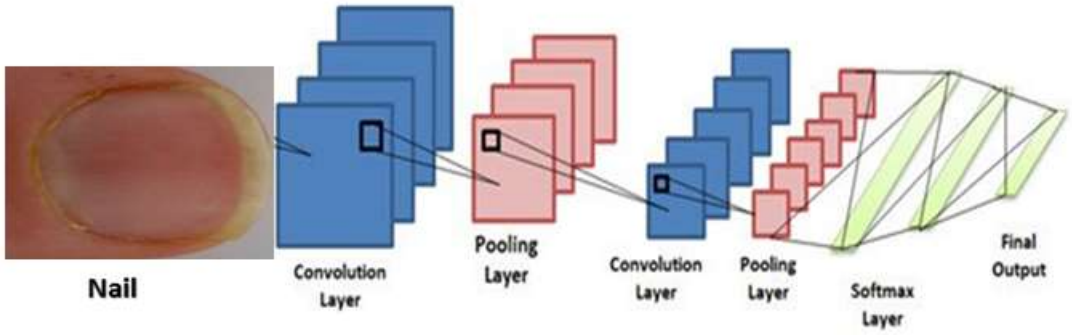
2. Decompose signal to wavelet(sub bands) LL,LH,HL,HH.

3. DWT retains images from LL to produce next level of decomposition , because the low frequency images has finer frequency and time resolution than high frequency images.

4. For each level of decomposition DWT produces 4 images and size is reduced to 1/4 of original image.

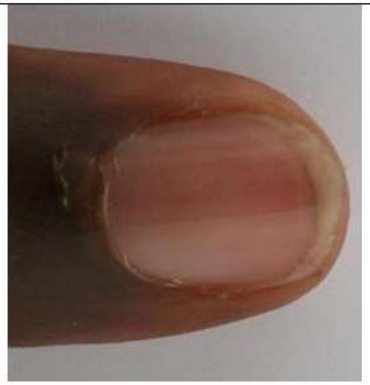
CNN CLASSIFATION:

- CNNs are a class of Deep Neural Networks that can recognize and classify particular features from images and are widely used for analysing visual images.
- Their applications can be seen widely in the medical images analysis.
- The term ‘Convolution” in CNN denotes that two images can be represented as **matrices** which are multiplied to give an output that is used to extract features from the image.



Dataset :

link:https://www.kaggle.com/reubenindustrustech/nail-dataset?select=dataset_nail

	Normal	Melanoma	Onycholysis
Train			
Test			
Validate			

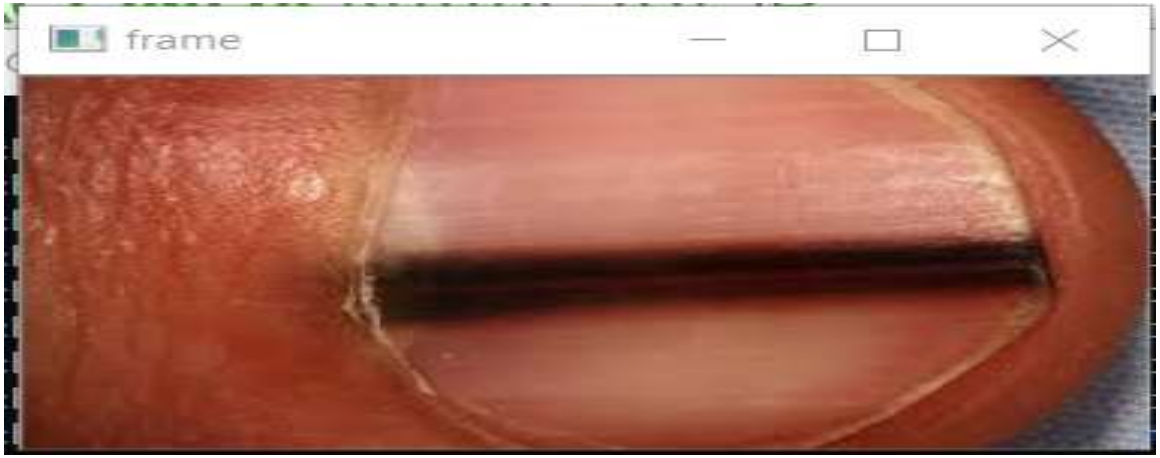
PERFORMANCE ANALYSIS

- The performance of the CNNs trained with the nail dataset was estimated by the classification performance of the models with the normal, melanoma and Onycholysis validation datasets.
- The performance of fine image selector helps in assessing image quality with the change in the illumination and reduction noise level of the images.
- The levels of brightness and noise were gradually reduced to classify the image easily.
- If the validation loss decreases then the accuracy will increase.
- The number of epochs should be as high as possible and terminate training based on the error rates.
- An epoch is one learning cycle where the learner sees the whole training data set.

- Here we are having 15epochs and we are getting 100% validation and training accuracy.
- In this experiment we found that using color feature of nail image average 80% results are correctly matched with training set data during three tests conducted and we are getting 80% accuracy on test dataset.

SCREENSHOTS

1)



2)

```
C:\windows\system32\cmd.exe - python  cnn_train_test.py
Epoch 4 --- Training Accuracy: 100.0%, Validation Accuracy:   0.0%, Validation Loss: 1.094
Epoch 5 --- Training Accuracy: 100.0%, Validation Accuracy: 100.0%, Validation Loss: 1.081
Epoch 6 --- Training Accuracy:   0.0%, Validation Accuracy:   0.0%, Validation Loss: 1.084
Epoch 7 --- Training Accuracy:   0.0%, Validation Accuracy: 100.0%, Validation Loss: 1.067
Epoch 8 --- Training Accuracy:   0.0%, Validation Accuracy: 100.0%, Validation Loss: 1.036
Epoch 9 --- Training Accuracy:   0.0%, Validation Accuracy: 100.0%, Validation Loss: 1.065
Epoch 10 --- Training Accuracy: 100.0%, Validation Accuracy: 100.0%, Validation Loss: 0.973
Epoch 11 --- Training Accuracy: 100.0%, Validation Accuracy:   0.0%, Validation Loss: 1.060
Epoch 12 --- Training Accuracy: 100.0%, Validation Accuracy: 100.0%, Validation Loss: 0.890
Epoch 13 --- Training Accuracy: 100.0%, Validation Accuracy: 100.0%, Validation Loss: 0.721
Epoch 14 --- Training Accuracy: 100.0%, Validation Accuracy:   0.0%, Validation Loss: 1.099
Epoch 15 --- Training Accuracy: 100.0%, Validation Accuracy: 100.0%, Validation Loss: 0.547
Time elapsed: 0:00:02
cnn_train_test.py:326: DeprecationWarning: `np.int` is a deprecated alias for the builtin `int`. To silence this warning
, use `int` by itself. Doing this will not modify any behavior and is safe. When replacing `np.int`, you may wish to use
 e.g. `np.int64` or `np.int32` to specify the precision. If you wish to review your current use, check the release note
link for additional information.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecation
s
  cls_pred = np.zeros(shape=num_test, dtype=np.int)
Accuracy on Test-Set: 80.0% (4 / 5)
Example errors:
Accuracy on Test-Set: 80.0% (4 / 5)
Example errors:
Confusion Matrix:
[[3 0 0]
 [0 1 0]
 [0 1 0]]
output test data: melanoma
```

CONCLUSION

- In the proposed technique we have trained a model that classifies the disease based on the pattern on the nail.
- This proposed system is able to predict the disease for the respective pattern of the nail with high accuracy.
- It is able to identify the small patterns also such that providing a system with higher success rate.
- The limitations of the existing model are eliminated by the proposed model.
- Moreover in the proposed system only the images of nails of fingers have been used for classifying the diseases, but in future we can combine other features of human body and predict various diseases based on the symptoms of patient and hence would be able to detect a lot of diseases with good precision and accuracy.

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PUBLICATIONS

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Link-

https://ijesc.org/upload/b296062b3a4b942cb82a164210b5b8cd.Early%20Stage%20Diseases%20Diagnosis%20using%20Human%20Nail%20in%20Image%20Processing.pdf

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