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# Applying Texture Feature Extraction for Skin Diseases using GLCM and GLRLM

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*Abstract: The proposed system classifies different types of dermatological skin diseases. The project mainly consists of three phases training phase, testing phase, and classification phase. First, collect the five skin disease datasets. Then divide the datasets into training and testing images. The datasets are in RGB format convert the images into grayscale. For extracting texture of an image, a statistical methods GLCM and GLRLM are used. GLCM features are contrast, correlation, homogeneity, and energy. GLRLM features are SRE, LRE, RP, GLNU, RLNU, LGRE and HGRE. Compare the texture features of training images with testing images and classify skin diseases such as Eczema, Melanoma, Dermatitis, Basal cell carcinoma, and Acne by using the ANN method. Compare the accuracy levels of both GLCM and GLRLM. GLCM gives 95% accuracy and GLRLM gives 93% accuracy.*

*Keywords: GLCM, GLRLM, ANN, Skin Diseases, RGB, Datasets.*

## I. INTRODUCTION

Dermatology is the part of the drug that manages skin, hair, and nails in the amplest sense. To propose a framework which would help the patients just as specialists to analyze the skin illnesses by simply giving the picture of the influenced region of skin. proposed location framework utilizes texture feature extraction strategies GLCM and GLRLM alongside ANN strategy for classifying the skin diseases. GLCM extract the features are contrast, correlation, homogeneity, and Energy. GLRLM extract the features are SRE, LRE, RP, GLNU, RLNU, LGRE, HGRE. The Skin diseases classification system comprises of three sections where the initial section is to train the folder of images. In training, surface highlights are chosen from the training images set by utilizing GLCM and GLRLM techniques after the change of RGB images into grayscale and store the pictures into a (.mat) table. In the second part is testing the images. The testing stage goes about as approval. In the testing stage, accepts one picture as information at that point convert the RGB picture into grayscale. GLCM and GLRLM texture feature extraction strategies are utilized. After feature extractions, store the incentive in another (.mat) table. The third part is the classification part. ANN classification used to classify skin diseases such as Eczema, Melanoma, Dermatitis, Basal cell carcinoma, and Acne. Compare the accuracy levels both GLCM and GLRLM methods.

### A. Literature Survey

*Shuzlina Abdul-Rahman [2016]:* This paper describes the skin diseases based on two feature selection methods Correlation Feature Selection (CFS) and Fast Correlation-based Filter (FCBF) help by offering a lesser number of properties with better accurateness and nearer react time.

*Nibaran Das [2013]:* The paper introduces an investigates on the ID of skin infections by using, Local Binary Pattern (LBP), GLCM, Discrete Cosine Transform (DCT) and Discrete Fourier Transform (DFT) have been utilized with Support Vector Machines (SVM) based classifiers.

*L. G. Kabari and F. S. Bakpo [2016]:* The above paper portrays the improvement of medicinal master frameworks that utilization ANN to be a promising technique for anticipating determination and conceivable treatment schedule.

## II. PROPOSED SYSTEM

The task is produced for the classification of skin diseases by examining the datasets such as Eczema, Melanoma, Dermatitis, Basal cell carcinoma, and Acne. At that point divide the datasets for training and testing. The datasets are coming in red green blue groups, convert both datasets into grayscale because GLCM and GLRLM feature extraction methods are utilized. The Project has three stages: (a) Training stage (b) Testing stage (c) Classification stage. In the training stage, the features are extracted from a given set of images. Contrast, Correlation, Homogeneity, and Energy are the texture features extracted by GLCM. Short Run Emphasis (SRE), Long Run Emphasis (LRE), Gray Level Non-uniformity (GLN), Run Length Non-uniformity (RLN), Run Percentage (RP),

Low Gray Level Run Emphasis (LGRE), High Gray Level Run Emphasis (HGRE) are the features extracted by GLRLM. After extract the texture features, store the values in (.mat) table. In the testing stage, accepts one picture as info at that point convert the RGB picture into grayscale because GLCM and GLRLM texture feature extraction methods are utilized. After extract the texture features store the values in another (.mat) table. In the classification stage, the ANN classification used to classify skin diseases such as Eczema, Melanoma, Dermatitis, Basal cell carcinoma, and Acne. Accuracy levels both GLCM and GLRLM strategies. GLCM technique gives 95% and GLRLM strategy gives 93%.
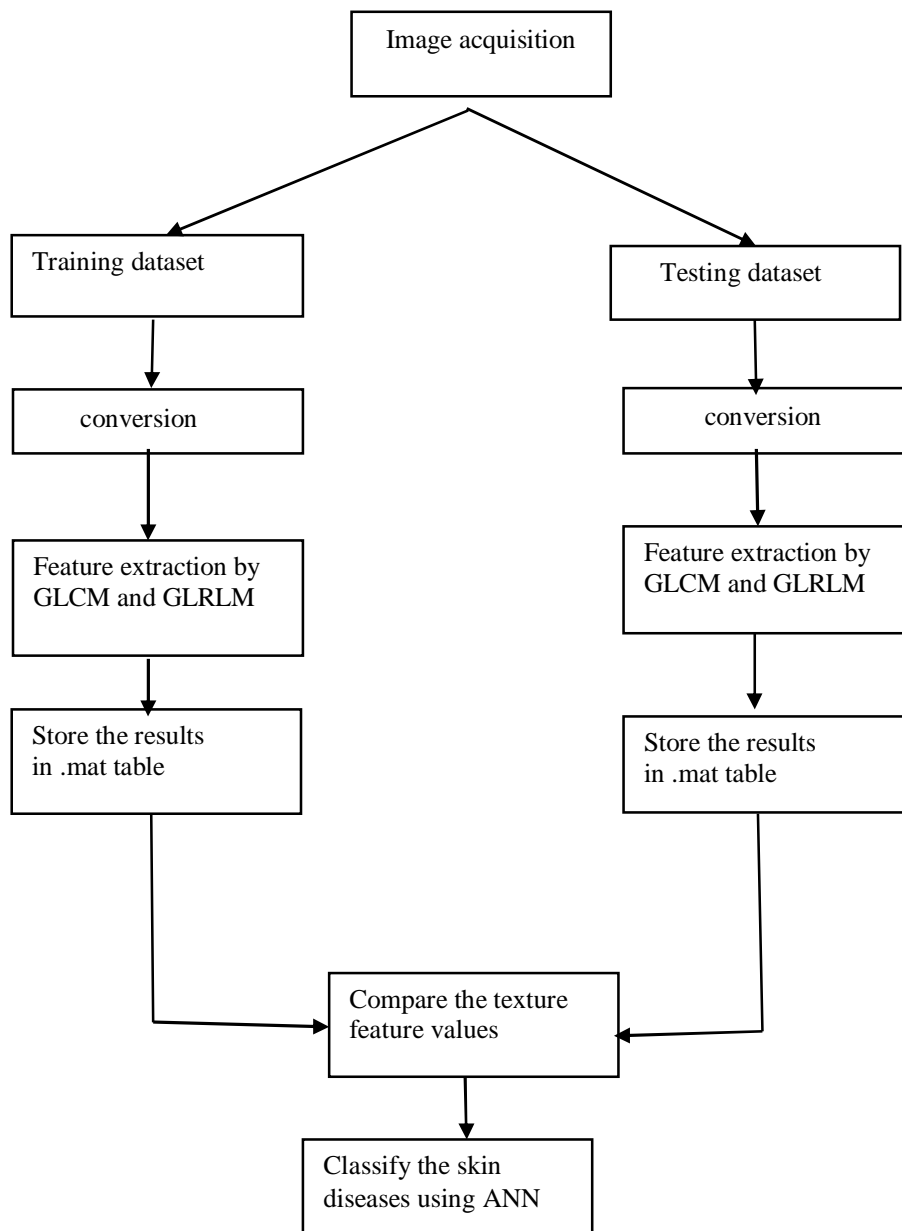


Fig. 1  Block diagram of skin diseases classification system

## III.    METHODOLOGIES

These methodologies are used to execute the project.

### A.  *Texture Features Extraction*

The texture is a repeated pattern of information or arrangement of the structure with regular intervals. texture refers to surface characteristics and appearance of an object given by the size, shape, density, arrangement, the proportion of its elementary parts.

1) *Gray Level Co-Occurrence Matrix:* A GLCM is a matrix where the number of rows and columns is equal to the number of distinct gray levels or pixel values in the image of that surface. The Texture feature calculations use the contents of the GLCM to give a measure of the variation in intensity at the pixel of interest. Typically, the co-occurrence matrix is computed based on two parameters, which are the relative distance between the pixel pair d measured in pixel number and their relative orientation. Normally, is quantized in four directions (e.g., $0^0$, $45^0$, $90^0$ and $135^0$)

TABLE I GLCM INPUT IMAGE

| 2 | 2 | 2 | 1 |
|---|---|---|---|
| 1 | 2 | 1 | 1 |
| 0 | 0 | 3 | 3 |
| 1 | 1 | 3 | 3 |

TABLE III
GLCM AT $0^0$ OFFSET

| ROWS (I) | COLUMNS(J) | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 0 | 1 | 0 | 0 | 1 |
| 1 | 0 | 2 | 1 | 0 |
| 2 | 0 | 2 | 2 | 0 |
| 3 | 0 | 0 | 0 | 1 |

TABLE IIIII
GLCM AT $45^0$ OFFSET

| ROWS (I) | COLUMNS(J) | | | |
|---|---|---|---|---|
| | 0 | 1 | 2 | 3 |
| 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 0 | 1 | 0 | 1 |

$0^0$ → pairing horizontally adjacent elements

$45^0$ → pairing right adjacent elements

$90^0$ → pairing vertically adjacent elements

$135^0$ → pairing horizontally left elements

TABLE IVV
GLCM TEXTURE FEATURES

| Features | Description | Formula |
|---|---|---|
| Contrast | Measurement of the intensity of pixel and its neighbor over the image | $\sum_{i=0}^{N-1} \sum_{j=0}^{N-1} (i-j)2\, p(i,j)$ |
| Correlation | how correlated a reference pixel to its neighbor over an image. | $\dfrac{\sum_{i=0}^{N-1} \sum_{j=0}^{N-1} P_{ij}}{1+(i-j)^2}$ |
| Homogeneity | calculate the degree of homogeneity of grayness in an image. | $\dfrac{\sum_{i,j=0}^{N-1} P_{ij}\,((i-\mu)(j-\mu))}{\sigma^2}$ |
| Energy | measurement of the extent of pixel pair repetitions. | $\sum_{i,j=0}^{N-1}(P_{ij})^2$ |

2) *Gray Level Run Length Matrix:* GLRLM is the number of runs with pixels of gray level i and run length j for a given direction. A set of consecutive pixels with the same gray level is called a gray level run. The number of pixels in a run is the run length. GLRLM also have four offsets like GLCM.

TABLE V

GLRLM INPUT IMAGE

| 0 | 1 | 2 | 3 |
|---|---|---|---|
| 0 | 2 | 3 | 3 |
| 2 | 1 | 1 | 1 |
| 3 | 0 | 3 | 0 |

TABLE VI

GLRLM AT $90^0$ OFFSET

| GRAY LEVEL (I) | RUN LENGTH(J) | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 0 | 2 | 1 | 0 | 0 |
| 1 | 4 | 0 | 0 | 0 |
| 2 | 3 | 0 | 0 | 0 |
| 3 | 3 | 1 | 0 | 0 |

TABLE VIV

GLRLM AT $135^0$ OFFSET

| GRAY LEVEL (I) | RUN LENGTH(J) | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 0 | 4 | 0 | 0 | 0 |
| 1 | 4 | 0 | 0 | 0 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 3 | 1 | 0 | 0 |

TABLE VIIVI GLRLM texture features

| Features | Description | Formula |
|---|---|---|
| SRE | measures the distribution of short runs | $$\dfrac{\sum_{i=1}^{Ng}\sum_{j=1}^{Nr}\dfrac{P(i,j\mid\theta)}{j^2}}{Nz(\theta)}$$ |
| LRE | measures the distribution of long runs | $$\dfrac{\sum_{i=1}^{Ng}\sum_{j=1}^{Nr}P(i,j\mid\theta)j^2}{Nz(\theta)}$$ |
| GLNU | measures the distribution of over the gray values | $$\dfrac{\sum_{i=1}^{Ng}(\sum_{j=1}^{Nr}P(i,j\mid\theta))^2}{Nz(\theta)}$$ |
| RLNU | measures the distribution of over the run lengths | $$\dfrac{\sum_{i=1}^{Nr}(\sum_{j=1}^{Ng}P(i,j\mid\theta))^2}{Nz(\theta)}$$ |
| RP | RP measures the fraction of realized runs and maximum number of potential runs. | $$\dfrac{Nz(\theta)}{Np}$$ |
| LGRE | LGRE is a gray level analog to short runs emphasis. | $$\dfrac{\sum_{i=1}^{Ng}\sum_{j=1}^{Nr}\dfrac{P(i,j\mid\theta)}{i^2}}{Nz(\theta)}$$ |
| HGRE | HGRE is a gray level analog to long runs emphasis | $$\dfrac{\sum_{i=1}^{Ng}\sum_{j=1}^{Nr}P(i,j\mid\theta)i^2}{Nz(\theta)}$$ |

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NG        → NUMBER OF INTENSITY VALUES IN THE IMAGE

Nr        → Number of run lengths in the image

NP        → Number of pixels in the image

NZ ($\theta$)    → Number of runs in the image along angle $P(i,j \mid \theta)$

### B. Classification

After texture features have been extracted which are contributes to a classifier to characterize skin diseases. In order, Artificial Neural Network weight enhancement has been utilized to characterize the skin diseases.

1) *Artificial Neural Network:* An ANN is prepared by changing the loads, to foresee the right class. An ANN is a computational model. It depends on the structure and elements of the neural system. ANNs have three layers that are interconnected. The primary layer comprises of info neurons. Those neurons send information on to the second layer, which thus sends the yield to neurons of the third layer. ANN classify skin diseases such as Basal cell carcinoma, Eczema, Melanoma, Dermatitis, and Acne. ANN classification additionally shows the Performance, Training state, Error Histogram, Regression, Fit of the training and Testing images.
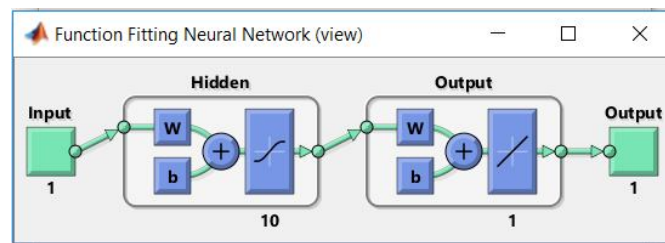

Fig. 2  ANN classification

## IV.  PROJECT IMPLEMENTATION

### A. Image Acquisition

Five skin diseases images were collected such as Eczema, Melanoma, Dermatitis, basal cell carcinoma, Acne from www.dermnet.com data source.
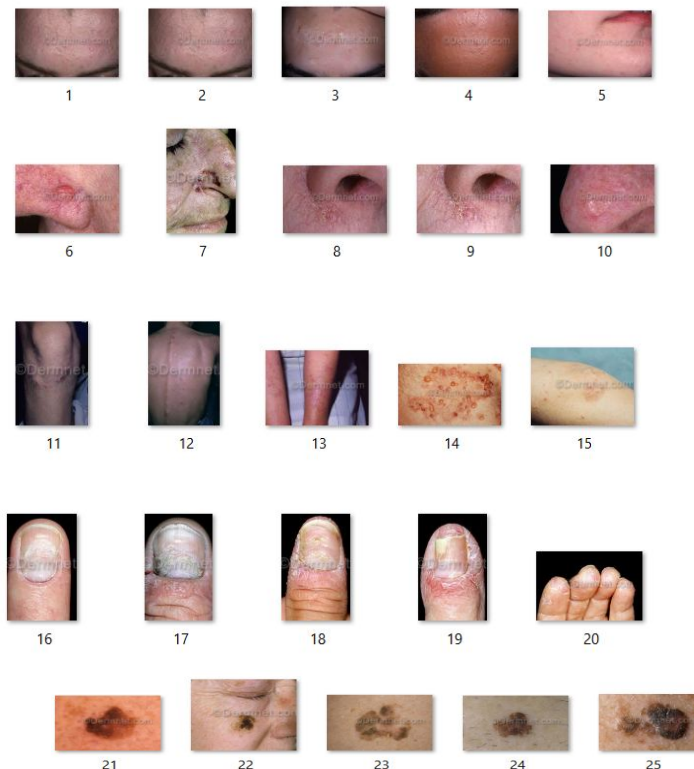

Fig. 3 Skin diseases datasets

### B. Conversion

The datasets are in RGB format convert the dataset into grayscale because of GLCM and GLRLM texture feature extraction methods are used. Grayscale is the accumulation or the scope of monochromic (dark) shades, extending from unadulterated white on the lightest end to unadulterated dark on the contrary end. Grayscale just contains luminance data and no shading data



Fig. 4 Conversion

### C. Feature Extraction

The procedure of picture highlights extraction is completed with surface examination utilizing the Gray Level Co-Occurrence Matrix (GLCM) and Gray Level Run Length Matrix (GLRLM) technique. The surface is a rehashed example of data or a course of action of the structure with normal interims. A surface alludes to surface qualities and presence of an article given by size, shape thickness, game plan and extent of basic parts.

TABLE VIIX

GLCM texture feature values

| Data sets | GLCM TEXTURE FEATURES | | | |
|---|---|---|---|---|
| | contrast | correlation | Homogeneity | energy |
| 1 | 0.21 | 0.92 | 0.89 | 1.55 |
| 2 | 0.12 | 0.94 | 0.93 | 0.29 |
| 3 | 0.27 | 0.92 | 0.87 | 0.17 |
| 4 | 0.17 | 0.79 | 0.87 | 0.41 |

TABLE X

GLRLM TEXTURE FEATURE VALUES

| Data sets | GLRLM TEXTURE FEATURES | | | | | | |
|---|---|---|---|---|---|---|---|
| | SRE | LRE | GLN | RP | RLN | LGRE | HGRE |
| 1 | 0.01 | 0.11 | 0.67 | 0.02 | 2.06 | 0.01 | 0.67 |
| 2 | 0.04 | 0.02 | 6.23 | 0.01 | 9.32 | 0.14 | 6.23 |
| 3 | 0.01 | 0.12 | 1.07 | 0.02 | 2.51 | 0.01 | 1.07 |
| 4 | 0.01 | 0.15 | 0.95 | 0.02 | 1.78 | 0.01 | 0.95 |

### D. Classification

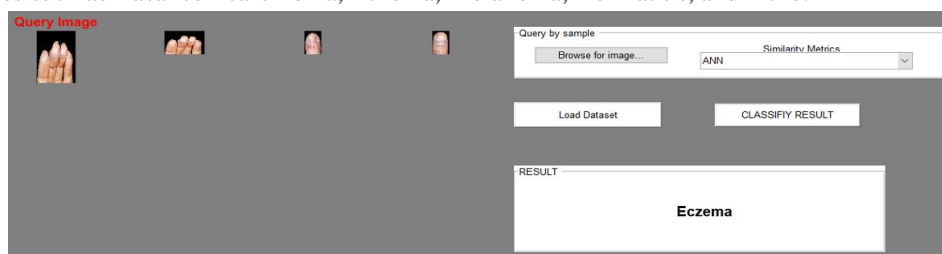Classifies skin diseases such as Basal cell carcinoma, Eczema, Melanoma, Dermatitis, and Acne.



Fig.5   Classification of skin diseases

## V. RESULT

$$Accuracy = \frac{TP+TN}{TP+FP+FN+TN} \times 100\%$$

TP → True positive

TN → True Negative

FP → False positive

FN → False Negative

GLCM gives 95% accuracy while GLRLM gives 93% accuracy.

## VI. CONCLUSIONS

In the proposed work classifies the five skin diseases, for example, basal cell carcinoma, melanoma, Eczema, Dermatitis, and Acne. Four texture features are extracted in GLCM, for example, Contrast, Correlation, Homogeneity, and Energy. Seven texture features are extracted in GLRLM, for example, LRE, HRE, RP, HGRE, LGRE, GLN, and RLN. Compared to GLRLM, GLCM gives better accuracy.

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