CHAPTER 2
LITERATURE SURVEY AND SKIN IMAGE DATABASE

The Related work about the skin image processing and their multiple applications using different kinds of methods and approaches. It is also describes various methods and techniques used in skin cancer detection process which is used to detect of tuberculosis utilizing technical and medical approach. From the elaborate literature is the motivation for the present proposed work.

2.1 Image Processing Techniques

The various image processing techniques involved in the skin cancer recognition process. The author focuses on the classification, segmentation, and detection of skin lesion [17]. The Dermoscopy is one of the main imaging modalities utilized in the skin lesions diagnosis for example melanoma and other pigmented lesions. Then, so as to reduce the diagnostic errors that result from the difficulty and the development of computerized, subjectivity of visual interpretation, image analysis methods is chief significance. This work also present a method for the analysis of skin lesion detection approaches, which contains of image acquisition, pre-processing, segmentation, feature extraction, and classification, based on ABCD rule. ABCD feature is utilized to compute Total Dermatoscopic Score (TDS) for melanoma skin cancer analysis.

A comparative study on different techniques to pre-process the lesion image to enhance its readability and the techniques that automatically segment skin lesions from images [18]. Moreover, pros and cons of various methods are also focused to provide a help for the researchers starting work in automated lesion detection system. The bio-medical investigation from images through computational techniques is very common in these days. Automatic Lesion extraction from skin is very important to aid the dermatologists in the diagnosis of cancer part from skin. Usually, some skin lesions are very subjective and small, therefore not detected by the clinicians by visual examination, the clinicians have some problems in their classification.
The authors explore the pre-processing and segmentation techniques needed for designing the automated skin Lesion detection system. It is a study that combines the research being done in this field. It presents knowledge that help the researchers judge the importance of high level techniques and algorithms for pre-processing, segmentation, feature extraction and selection which needs more effort for making correct diagnosis of melanoma. It will be a great help and preliminary guide for the researchers starting work in skin lesion detection systems.

2.2 Contrast Enhancement Techniques

The Pre-processing as the basis of automation system plays a vital role for accurate detection [19]. This work implements three techniques of contrast enhancement in the framework of three methodologies to find out the most effective one for further processing. The quality of resulted images in each methodology has been found based on testing the skin cancer images database using three image quality measurements. Researchers targeting increasing of the diagnosis accuracy and this paper present a quick review on the design of whole system and focus in pre-processing step of the automatic system. Pre-processing as the basis of automation system plays a vital role for accurate detection. Three Contrast Enhancement techniques, namely, Adaptive Histogram Equalization, Histogram Equalization and un sharp masking have been implemented to compare the most effective one in pre-processing stage of skin cancer detection system. After applying the pre-processing techniques, the image segmentation is performed. The resulted images of each methodology are compared with its patterns using three measurements of Modified Hausdorff distance, Euclidean distance and Correlation to estimate the more similar one to the pattern for determining the best contrast enhancement technique.

2.3 Diagnosing Technology

The various diagnosing technologies are performed for detecting the skin cancer. Different technologies and its important features are described in detailed manner.
- **Ultra Sound**
  
  This provides information about skin’s inflammatory processes. However, it miscalculates tumor thickness. The images from this scheme can be problematic to understand.

- **Tape Stripping mRNA**

  This is a painless, fast and simple approach for any skin. However, it also needs greater gene expression profile for evaluation.

- **Solar Scan®- Polytechnics Ltd., Sydney, Australia**

  The Solar Scan associates the features against images of non-melanomas and melanomas in a database and a recurred an instruction to a common physician. It proceedings a graphic map of the body, but needs oil immersion. Additionally, it needs an experiential database for the session, comparison, and accuracy of image level standardization.

- **Intracutaneous Analysis (SIA)- Clinica, Cambridge, UK**

  Conventional broadband white light. It does a diagnosis of lesions less than 2mm in diameter. It has a handheld scanner. It additionally senses reticular pigment networks, vascular composition, and skin structures.

- **Spectrophotometric Intracutaneous Analysis (SIA)- SIA scope, Astron Clinica, Cambridge, UK**

  The SIA uses 12 wavebands to evaluate the skin instead of broadband conventional white light. It also a handheld scanner. It processes the diagnosis of lesions less than 2mm in diameter. Additionally detects reticular pigment networks, vascular composition, and skin structures.

- **Optical Coherence Tomography (OCT)**

  It detentions high-resolution images than ultrasound and superior depth than CSLM. The ointment is required to minimize sprinkling and rise detection depth.

- **MoleMax™- Derma Medical Systems, Vienna, Austria**

  This is a computer aided polarized light dermoscopy which is utilized for
high-resolution handheld video dermoscopy for close-up imaging. It routines two camera structures for total body photography. However, there is no computer diagnostic analysis.

- **MelaFind® - MELA Sciences, Inc., Irvington, NY, USA**

  This sort of digital dermoscopy with specialized probe and software to support and discriminate between skin lesions and other melanoma. It has a used scanner. It generates an image’s multispectral sequence in below three seconds

- **Electrical Bioimpedance**

  It completes the whole progression in seven minutes. However, it affected by the different impedance human skin properties

- **Confocal Scanning Laser Microscopy (CSLM) - VivaScope 3000, Lucid, Rochester, NY, USA**

  It has a flexible scanner. It’s longer wavelengths can process into papillary dermis. It uses a depth of 300µm. Nonetheless, melanomas without in situ component will prospective escape discovery pattern. It obtained the poor resolution patterns.

### 2.4 Filter and Adaptive Histogram Technique

The adaptive histogram equalization technique used for preprocessing operation. In this work use novel classification and segmentation of skin lesions [20]. The main aim of this work is skin cancer detection system with a minimum error by selecting the proper approach in each and every stage. The standard digital camera is used for capturing the skin lesion image is shows the high screening process of lesion image.

The combination of an analytical method and segmentation method the aims to enhance these two approach so as to create an interface for assist dermatologists for diagnostic process [21]. The initial step in this work, a series of preprocessing is executed to unwanted structures and removes noise from the given image. Then, an automatic segmentation method traces the skin lesion. Send step is feature extraction is done by using ABCD rule which used to calculate the Total Dermoscopy score.
In this work, three diagnosis methods are utilized such as benign skin lesion, suspicious and melanoma. The experimental work uses 40 images which comprising suspicious melanoma skin cancer. From the experimental results in this work obtain 92% classification accuracy reflects its viability.

The preprocessing technique, morphological operations for removing the hair was used [22]. The edge detection techniques such as Prewitt and Sobel filter are to detect affected area. These methods have been tested on online skin disease datasets. It has implemented the morphological operations for removal of hair. The foreground is removed in the first phase using Opening operation whereas in second phase, closing operation removes the background. Morphological operation has given the hair removed image that helped in further processing. Finally, Edges are detected by using Prewitt edge detection and Sobel edge detection techniques. The morphological operation gives better Peak Signal to Noise Ratio and Mean Square Error values, Prewitt edge detection is better than Sobel edge detection based on the PSNR value.

2.5 Gaussian Method

The proposed work of this author comprises of Pre-Processing, Segmentation, Feature extraction and Classification [23]. In the Pre-Processing stage, Weiner Filter is implemented to remove noise and undesired structures from the images. In the Segmentation stage Distance Regularized Level Set (DRLS) method is implemented in order to acquire a contour by means of the gradient flow that minimizes an energy function with a distance regularization term and an external energy that drives the motion of the zero level set toward desired locations. Support vector machine (SVM) classifier is employed for the classification task, utilizing feature vectors derived from Gray Level Co-occurrence (GLCM) features.

The classification results are evaluated with the use of accuracy, sensitivity and specificity. The skin image preprocessing and smoothing approaches are combined and skin image’s RGB means values that combine to 2-D histograms and GAUSSIAN method. This approach makes use of automatic detection of the color skin medical image. The experimental result shows that the Gaussian method obtains the promising result in over human skin detection.
The approach of reducing one degradation at a time allows us to develop a restoration algorithm for each type of degradation and simply combine them. The Wiener filtering executes an optimal trade-off between inverse filtering and noise smoothing. It removes the additive noise and inverts the blurring simultaneously. The Weiner Filter exploits correlation information between signal and noise to reduce distortion.

The segmentation processing of Magnetic Resonance Images (MRI) by utilizing Unsupervised Neural Network Algorithm (UNNA) [24]. Here considering two different kinds of problems: such as the trained network takes a long time to obtain the Desired Output. Another one has obtained results from the training process are not correct which contain a lot of noise as a result of the training process. Thus, in this work employed the 2D Discrete Wavelet Transform (DWT) learned Patterns for de noise operation (noise removal or reduction) by processing entire the outcomes from the activity of the segmentation of MRI. The UNNA like Kohonen Network considering the outcome image and the trained process is findings the given original images. There was a reduction training time as well as give the better performance of the skin cancer patients diagnosis system. The quality of the image by utilizing the de-noising and resolution concepts such as wiener filter, median filter, average filter, discrete wavelet transform and the dual tree based complex wavelet transform approach. This approach eliminates the noise present in the image and improving the quality of the image which is used to identify the cancer with efficient manner. Then the performance is evaluated using the PSNR metrics.

The different preprocessing methods for detecting the lesions and micro calcification from the mammogram image [25]. These preprocessing methods eliminate the unwanted noise present in the input image which is implemented in the MATLAB tool. Then the performance of the preprocessing techniques has been evaluated using the 30 different mammogram image and the efficiency is analyzed using the peak signal to noise ratio. From the discussions the anisotropic techniques and median filtering eliminate the noise with efficient manner when compared to the other preprocessing techniques such as un sharp masking, morphological processing and so on.
Enhancing the quality of the images by applying the filtering and resolution methods such as median, average, and wavelet filters [26]. These filters estimates the neighboring pixel value for estimating the new brightness values with efficient manner. In addition these filters maintains the quality of the edge and contour information. Then the performance of the system is analyzed using the peak to signal ratio metrics. These resolution based preprocessing methods improves the quality also enhance the classification accuracy with efficient manner.

2.6. Segmentation Techniques

In this section discusses about the various analysis about the segmentation process for recognizing the skin cancer. This is a new intelligent method of classifying benign and malignant melanoma lesions are implemented [27]. The system consists of four stages; image pre-processing, image segmentation, feature extraction, and image classification. As the first step of the image analysis, pre-processing techniques are implemented to remove noise and undesired structures from the images using techniques such as median filtering and contrast enhancement. In the second step, a simple thresholding method is used to segment and localize the lesion, a boundary tracing algorithm is also implemented to validate the segmentation.

Then the wavelet approach is used to extract the features, more specifically Wavelet Packet Transform (WPT). Finally, the dimensionality of the selected features is reduced with Principal Component Analysis (PCA) and later supplied to an artificial neural network and support vector machine classifiers for classification. The ability to correctly discriminate between benign and malignant lesions was about 95 percent for the Artificial Neural Network and 85 percent for the Support Vector Machine classifier.

Melanoma is sort of dangerous skin disease; it can be diagnosed only in its early stage but using the normal conventional dermatological approach is difficult one. An image processing approach by using an efficient segmentation algorithm named a radial search method to obtain the true of the lesion region in dermoscopy skin images [28]. The thresholding method is applied in segmentation process and finds the edge using radial search process. The radial search approach is called as a semi-automatic method and it requires the manual initialization to start the process.
Finally, the three types of features are extracted from the segmented image such as border, color, and asymmetry. The different digital images based on unsupervised segmentation techniques [29]. The application of image processing for diagnostics purpose is a non-invasive technique. There is currently a great interest in the prospects of automatic image analysis method for image processing, both to provide quantitative information about a lesion, which can be relevance for the clinical, and as a standalone early warning tool. In order to achieve an effective way to identify skin cancer at an early stage without performing any unnecessary skin biopsies, digital images of melanoma skin lesions have been investigated. To achieve this goal, feature extraction is considered as an essential-weapon to analyze an image appropriately. Feature extraction techniques are then applied on these segmented images. After this, a comprehensive discussion has been explored based on the obtained results.

The computer vision approaches have been developed for skin detection [30]. A skin detector typically transforms a given pixel into an appropriate color space and then uses a skin classifier to label the pixel whether it is a skin or a non-skin pixel. Skin classifier defines a decision boundary of the skin color class in the color space based on a training database of skin-colored pixels. Detecting skin-colored pixels, although seems a straightforward easy task, has proven quite challenging for many reasons. The appearance of skin in an image depends on the illumination conditions where the image was captured.

Humans are very good at identifying object colors in a wide range of illuminations, this is called color constancy. Color constancy is a mystery of perception. Therefore, an important challenge in skin detection is to represent the color in a way that is invariant or at least insensitive to changes in illumination. As will be discussed shortly, the choice of the color space affects greatly the performance of any skin detector and its sensitivity to change in illumination conditions. Another challenge comes from the fact that many objects in the real world might have skin-tone colors. For example, skin-colored clothing, hair, sand, etc. This causes any skin detector to have much false detection in the background if the environment is not controlled. Since skin detection depends on locating skin-colored pixels, its use is limited to color images, i.e., it is not useful with gray-scale, infrared, or other types of image modalities that do not contain color information.
There has been extensive research on finding human faces in images and videos using other cues such as finding local facial features or finding holistic facial templates. The human skin color has a restricted range of hues and is not deeply saturated, since the appearance of skin is formed by a combination of blood (red) and melanin (brown, yellow) [31]. Therefore, the human skin color does not fall randomly in a given color space, but clustered at a small area in the color space. But it is not the same for all the color spaces. Variety of color spaces has been used in skin detection literature with the aim of finding a color space where the skin color is invariant to illumination conditions.

The choice of the color spaces affects the shape of the skin class, which affects the detection process. Here, some color spaces, which are typically used in skin detection, are briefly described, and the way they affect the skin detection is discussed. This method demonstrated that skin filter can be used as part of the detection process of images with naked or scantily dressed people. Their technique has three steps. First, a skin filter, based on color and texture, was used to select images with large areas of skin-colored pixels. Then, the output is fed into a geometric filter which identifies the skin-colored regions with cylindrical shapes. Those skin-colored cylinders are grouped into possible human limbs and connected groups of limbs. Images containing sufficiently large skin-colored groups of possible limbs are then reported as containing naked people. Human face localization and detection is the first step in obtaining face biometrics. Skin color is a distinguishing feature of human faces. In a controlled background environment, skin detection can be sufficient to locate faces in images.

2.7. Segmented Images With Pigmented

An automatic method for segmentation of images of skin cancer and other pigmented lesions is presented [32]. This method first reduces a color image into an intensity image and approximately segments the image by intensity thresholding. Then, it refines the segmentation using image edges. Double thresholding is used to focus on an image area where a lesion boundary potentially exists. Image edges are then used to localize the boundary in that area. A closed elastic curve is fitted to the initial boundary, and is locally shrunk or expanded to approximate edges in its neighbourhood in the area of focus.
Segmentation results from 20 randomly selected images show an average error that is about the same as that obtained by four experts manually segmenting the images. To analyze skin lesions, it is necessary to accurately locate and isolate the lesions. An automatic method for segmentation of skin cancer images was presented. This method starts with an initial segmentation and uses edge information in the neighbourhood of the initial segmentation to refine the results. An elastic curve model is used to represent the final segmentation. Although the method is devised for segmentation of color images, early on in processing, a color image is transformed into an intensity image where the intensity at a pixel shows the color distance of that pixel to the background. Intensities in the image obtained in this manner are then transformed according to a function to suppress details in the background and in a lesion while enhancing details across lesion boundaries. Transformation of a color image into an intensity image and mapping of image intensities to enhance lesion boundaries are considered to be the main contributions of this work.

The skin color segmentation method by k-mean clustering and texture feature extraction is proposed [33]. In this work enhanced the fundamental skin cataloging by combining both texture and color features for skin segmentation. After done the color segmentation here utilizing a 16 Gaussian Mixture Models (GMM) classifier, the texture features are obtained by utilizing effective a 2-D Daubechies Wavelet with wavelet transform and characterized as a list of Shannon entropy. The non-skin regions can be eliminated by the Skin Texture-cluster Elimination using K-mean clustering. The experimental analysis shows that the promising result when compared with another existing approach with false positives 20.5 percent and with true positive of 90.3 percent for the normal case and with false positives 25.2 percent and with true positive of 96.5 percent for the worst case.

The different digital lesion images based on image segmentation techniques, pre-processing and unsupervised image acquisition [34]. The application of image processing for diagnostics purpose is a non-invasive technique. At present there is a great interest in the prospects of automatic image analysis method for image processing, which provides significant information about a skin lesion, also can be more applicable for the clinical purpose, and as an early warning tool for the detection purpose.
In order to accomplish an efficient way to identify skin cancer at an early stage without performing any unnecessary skin biopsies, digital images of skin lesions have been investigated. To complete this goal, feature extraction is considered as an essential-weapon to analyze an image properly. After this process the Feature extraction method on these segmented images. Then, designed a graphical user interface for the lesion probability detection and after this work explored a comprehensive discussion based on the obtained results.

The melanoma skin cancer by using the Otsu thresholding which is used to segments the lesion from the whole image [35]. Further segmentation is done by using a Boundary tracing algorithm. After removing the features from the lesion, classification process is done by using Stolz algorithm stage. The experimental analysis show that the promising results in term of better detecting various stages of skin cancer. The obtained results are showed in the form of statistical graphs and tables. The skin-tone regions with the help of edge detection and color spaces in green red channels [36]. The prominent feature of face is extracted by using wavelet approximations. The experimental results obtain the enhanced False Acceptance Rates (FAR) over the either utilizing grey scale image for segmentation and which algorithm not using any kinds of edge detection.

2.8. Artificial Neural Network Based Techniques

The ANN-based Classification methodology utilizing Artificial Intelligence and Image processing approach for early diagnosis [13]. In this work dermoscopy image of skin cancer is taken for analysis using Computer Aided Classification, and it is considered different kinds of image enhancement and pre-processing. Cancer affected area is detached from the healthy skin utilizing Segmentation process. So as to minimize the classification complexity, some unique features of benign melanoma and malignant are obtained. The 2DWavelet transform is well-known Feature Extraction approach is used in this work. These features are feed into as input as in ANN Classifier. It classifies the given data set into non-cancerous or cancerous.

The automatic cancer detection process by utilizing the effective image segmentation process [37]. Before segmenting the image, the noise present in the image should be eliminated by converting the RGB images into the Grayscale image.
Then the region growing method has been applied to the noise removed image which combining the similar gradient value based on the image intensity constraints. From the segmented image the affected region related features are calculated which is fed into the supervisor classifier to analyzed the cancer with effective manner.

The tumor region by utilizing the fuzzy c means based support vector machine [38]. Initially the MRI image neighboring pixel value has been analyzed and the input is labeled by using the Fuzzy C - Means method. From the input vectors the membership function is applied and the affected region is efficiently segmented by using the support vector machine. Then the proposed FCM with Support Vector Machine based segmentation methods has been analyzed using the quadratic kernel function and the non-linearity approach. Thus the proposed method enhances the segmentation process which used to achieve the enhanced results while classifying the segmented region. Finally the performance of the system is compared with the silhouette method, fuzzy entropy, fuzzy partition coefficient methods.

2.9. Feature Extraction Techniques

The various feature extraction process for recognizing the cancer [39]. The author examined skin cancer detection using the computer aided diagnosis process. Biopsy method is known as Conventional diagnosis method is used for the skin cancer detection process. It is done by scraping or removing off skin and these samples fed into series of laboratory testing. In this work utilize a neural network (NN) system as promising modalities for the skin cancer detection process. In this work involves different stages of detection which contain a collection of Dermoscopic images, feature extraction utilizing GLCM and classification utilizing ANN, segmenting the images utilizing Maximum Entropy Threshold, filtering the images for removing noises and hairs, It classifies the given data set into the non-cancerous or cancerous image. Cancerous images are classified as non melanoma and melanoma skin cancer.

The diagnosing methodology uses Artificial Intelligence and Image processing techniques [40]. The dermoscopy image is taken and then the different pre-processing operation is done for image enhancement and noise removal. After that, the image is fed into the segmentation process utilizing Thresholding.
There are particular unique features are considered for skin cancer regions and that features are obtained by utilizing a feature extraction method such as 2D Wavelet Transform approach. The obtained features are given as the input nodes to the ANN. Then classification process is done by using Back-Propagation Neural (BPN) Network. It categorizes the given data set into non-cancerous or cancerous. The different kinds of stages of detection include collection of dermoscopy images, segmenting the images utilizing the Maximum Entropy Threshold, filtering the images for removing hair and noises, feature extraction using the GLCM, and classification done by utilizing ANN.

The earlier period and current technologies for skin cancer detections [41]. Malignant melanoma is one of the most common and the deadliest type of skin cancer. Skin cancer is commonly known as Melanoma. Skin Cancers are of two types- Benign and Malignant Melanoma. Melanoma can be cured completely if it is detected early. Both benign and malignant melanoma resembles similar in appearance at the initial stages. So it is difficult to differentiate both. This is a main problem with the early skin cancer detection. Only an expert dermatologist can classify which one is benign and which one is malignant. This work focuses on developing a new computer-aided diagnosis method for melanoma. With the aim of improving some of existing methods and developing new techniques to facilitate exact, prompt and dependable computer-based diagnosis of melanoma, this makes contributions in various stages of a computer-aided diagnostic system of melanoma; namely, image segmentation or border detection, feature extraction, feature selection, and classification.

The decision support system for early skin cancer detection that relies on analysis of the pigmentation characteristics of a skin lesion, detected using cross polarization imaging, and the increased vasculature associated with malignant lesions that is detected using trans illumination imaging [42]. Current system uses size difference based on lesion physiology and achieves great overall accuracy (86.9%). Texture information is one of the criteria dermatologists use in the diagnosis of skin cancer, but has been found very difficult to utilize in an automatic manner. The overarching goal is to improve the overall decision support capability of the Decision Support System. The objective is to use texture information ONLY to classify the benign and malignancy of the skin lesion.
A three-layer mechanism that inherent to the support vector machine (SVM) methodology is employed to improve the generalization error rate and the computational efficiency. The performance of the algorithm is validated with a series of benchmark texture images and then tested on 22 pairs of real clinical skin lesion images. Our experimental results show that a 4th-order polynomial kernel can reach an average accuracy of 70% in determining the malignancy of any pixel within any given skin lesion image. Further study will look at whether multi-channel filtering based feature extraction algorithm will improve the accuracy rate, and the performance comparison between SVM-based texture classification and decision tree-based texture classification in both the spatial and frequency domain.

### 2.10. Correlation Techniques

The proposed skin texture profile correlation with the malignant melanoma skin cancer detection system [43]. Basically, the skin’s histogram profile about skin texture is flat. Thus, in this work shifted the skin texture analysis to the analysis of the gray level profile. The skin texture gray color profile may give a fundamental idea about the sensitivity of skin and is shown that the new developing skin texture analysis tool. The skin gray color profile is considered as the input parameter so as to determine the skin profile. An SVM classifier is trained to categorize the various kinds of skin images depends on the GLCM features. The SVM classifier classifies very well skin images into their corresponding classes utilizing GLCM features.

An automated approach for melanoma diagnosis employed on a set of dermoscopy images [44]. Features extracted are based on gray GLCM and utilizing Multilayer Perceptron (MLP) classifier to categorize between malignant Melanoma and Melanocytic Nevi. In this work, the MLP classifier was proposed with two different kinds of method for testing and training process: Traditional MLP and Automatic MLP. Results designated that texture analysis is a helpful approach for refinement of melanocytic skin tumors with great accuracy. The first method, the Automatic iteration counter is faster, but the second one, Default iteration counter provides an enhanced accuracy, which is 92 % for the test set and 100 % for the training set.
Skin texture analysis is one of the challenging issues in the field of medical diagnosis [45]. Various types of skin diseases are affecting human life like skin dryness, fungus, and allergic symptoms. In the existing scenario, the skin images are analyzed in frequency domain. However, it is observed that the skin color in texture images does not vary over a wide range. Hence, the histogram profile of the skin texture remains almost flat. In the proposed work, shifted the skin texture analysis towards the gray level profile analysis. In the proposed thesis work, Gray Level Co-occurrence Matrix of the skin image is computed. The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix. Further, the image entropy and energies are also computed in order to correlate the skin symptoms to the skin texture images.

In this work diagnosis the psoriasis skin disease [46]. This work process with both skin texture and color features (GLCM) to give a more efficient and better recognition results. Feed Forward Neural Networks are used to classify the image as non-psoriasis infected or psoriasis infected. This proposed system gives the promising results in term of finding the generalization face. Extracting the shearlet features from the ultrasound cancer image for detecting the normal and abnormal tissues in the affected part. The shearlet transform analyze the image and the texture metrics are analyzed in the high dimensional way. The extracted features are classified by applying the different classifiers such as the support vector machine, ad boost technique. The extracted features are compared with the different feature extraction techniques such as the contourlet, curvelet and GLCM approach. The performance of the proposed system is analyzed using the experimental results in terms of the accuracy, sensitivity, specificity, predictive values.

The different feature extraction methods such as intensity histogram, intensity based features and the Gray Level Co-occurrence Matrix [47]. These methods are used to extracted features from the preprocessed image and the features are fed into the supervised classifier like neural network. The neural network efficiently classifies the cancer and the performance of the proposed system is analyzed using the digital database mammography image. Thus the gray level co-occurrence matrix provides the efficient features for identifying the normal and abnormal growth of the tissues.
The classification detection process by extracting only the specified features such as shape, intensity and histogram values. The captured images are processed by applying the gamma correction process and the light intensity based features are extracted. The extracted features are classified as the support vector machine which classifies into the malignant and benign. The performance of the system is analyzed using the different feature extraction methods.

2.11. Feature Selection Techniques.

Automatic detection of cancer by selecting the optimal feature set from the various features[48]. The different intensity, texture based features are extracted from the segmented image then the haralick and features are selected from the set of features. During the feature selection process, the features are ranked and the best features are selected using the wrapper approach. Then the selected features are fed into the k-nearest neighbor classifiers which classifies the cancer into the benign and malignant. Thus the proposed system efficiently classifies the tumors with effective manner.

Automated cancer detection process is performed by utilizing the image [49]. The extracted features are fed into the supervised and unsupervised filter based feature selection method. The feature selection method analyze the list of features with various dimension and the optimal features are selected using the particular rank value. The optimal features are fed into the different classifiers which analyze features and classifies as the normal and abnormal tissues. Then the efficiency of the system is analyzed using the different feature selection method in which the proposed filter based approach ensure the higher accuracy while detecting the cancer.

Analyzing the various feature selection methods such as information gain, gain ratio, best first search algorithm, chi-square test, recursive feature elimination process and the random forest approach [50]. These features are selects the optimal features from the set features such as the texture, shape, color and other spectral features. The selected features reduces the dimensionality of the feature set which is fed into the different machine classifiers for identifying the normal and abnormal tissues. Thus the optimal features ensures the efficient results with minimum time complexity.
In the classification method of dermoscopy images between melanocytic skin lesions (MSLs) and non-melanocytic skin lesions (No MSLs) [51]. The motivation of this research is to develop a pre-processor of an automated melanoma screening system. Since No MSLs have a wide variety of shapes and their border is often ambiguous, the developed new tumor area extraction algorithm to account for these difficulties. This method confirmed that this algorithm is capable of handling different dermoscopy images not only those of No MSLs but also MSLs as well. We determined the tumor area from the image using this new algorithm, calculated a total 428 features from each image, and built a linear classifier and found only two image features, “the skewness of bright region in the tumor along its major axis” and “the difference between the average intensity in the peripheral part of the tumor and that in the normal skin area using the blue channel” were very efficient at classifying No MSLs and MSLs. The detection accuracy of MSLs by our classifier using only the above mentioned image feature has a sensitivity of 98.0% and a specificity of 86.6% in a set of 107 non-melanocytic and 548 melanocytic dermoscopy images using a cross-validation test. According to the selected features, it has been sent to the different classifiers for recognizing the cancer with effective manner.


In this work use the soft computing techniques for analyzing the skin lesion image [52]. Here differentiate the melanoma skin lesions is done by using ABCD and this approach is also done the preprocessing operation and finally the optimization is done by soft computing operation. The author shows the better accuracy in term of diagnosing the melanoma. An intelligent automated approach for identifying the different sort of skin lesions utilizing machine learning procedures. Two sorts of texture feature have been utilized to perform classification of non-melanoma and melanoma. Initially, local information is getting over the Local Binary Pattern (LBP) on various kinds of scales and GLCM at different angles has been mined as a kind of texture features. Typically, these features are robust because of scale rotation invariant property of GLCM features and invariant property of LBP. The Global information of altered colors channels has been integrated through four various moments mined in six different color spaces. Thus a merged hybrid texture color and local as global features have been recommended to categorize the non melanoma and melanoma. The SVM has been utilized as a classifier to classify non-melanoma and melanoma.
An adaptive skin detector for detecting naked pictures on the internet [53]. Their technique applies a face detector on the picture first to find the skin color. They argued that as skin color highly depends on illumination and the race of the person, it is more appropriate to get the skin color from the face of the person in the image. Using the skin color and the property of the texture from the detected face region, the rest of skin pixels in the image can be detected. A novel approach is proposed which combines texture and color for the skin lesions segmentation from unaffected skin region in the given image. The distributions of texture and color features give a good perception of skin lesions. The LiveWire segmentation is done for evaluation of this work. The segmentation results are quantitatively evaluated in terms of a comparative experiment on a given set of skin cancer images. The results designate that this proposed work showed efficient and effective for the skin cancer image segmentation process. Different kinds of methods such as log filtering, k-means, k-nearest neighbor, fuzzy-based split-and-merge algorithm (FBM) Region refinement, adaptive snake (AS), Gradient Vector Flow (GVF) and adaptive thresholding (AT) has been utilized for melanoma segmentation images. Additionally, in this work collected dataset and discusses different kinds of segmentation methods.

A database comprising of skin burn images belonging to patients of diverse ethnicity, gender and age are considered [54]. First, the images are preprocessed and then classified utilizing the pattern recognition techniques: Support Vector Machine (SVM), k-nearest neighbor classifier (kNN) and Template Matching (TM). The classifier is trained for various kinds of skin burn grades utilizing pre-labeled images and then using the selected features is optimized. This algorithm developed as an automatic skin burn wound aids and analyzer in the burn victim’s diagnosis.

A computer-aided approach for the detection of Melanoma Skin Cancer Utilizing Image Processing tools [55]. In this work takes skin lesion image as an input image and after that by employing a novel image processing approach, it examines it to accomplish about the occurrence of skin cancer. In this work use the Lesion Image analysis tools to examine the different kinds of Melanoma parameters Like Asymmetry, Border, Color, Diameter (ABCD) etc. by shape, size and texture analysis for image feature stages and segmentation.
The mined feature parameters are utilized to categorize the image as Melanoma cancer lesion and Normal skin. The automatic skin detection process after an initial camera calibration and basically, the test individuals are taken from the human sampling [56]. A scaling is implemented on the work data, before employing the distance that confirms better results than preceding works. In this work use the TSL color space and also successfully utilized, where undesired effects are minimized and Gaussian model shows the better skin distribution process considering others color spaces. Additionally, utilizing an initial filter, generally, huge parts of effortlessly distinct non-skin pixels, are eradicated from further processing. Grouping and analyzing the resulting features from the discriminator progresses the ratio of precise detection and minimize the small non-skin region existent in a common complex image including interracial descent persons, Caucasian, background, African, and Asiatic. Also, this approach is not limited to grouping, size or orientation candidates.

The skin disease utilizing skin image texture analysis and by comparing the test image to reference images or defined images [57]. The matching of reference and test images compared that get the skin diseases percentage in the obtained skin texture image. The classification detection process by extracting only the specified features such as shape, intensity and histogram values. The captured images are processed by applying the gamma correction process and the light intensity based features are extracted. The extracted features are classified as the support vector machine which classifies into the malignant and benign. The performance of the system is analyzed using the different feature extraction methods.

2.13  Digital Image Utilizing Technique

The object recognition and detection and in a digital image utilizing a classification approach which is done depends on a set of application of features which include two different kinds of fractal parameters such as the Fractal Dimension and Lacunarity [58]. The fundamental problem linked with the object recognition process is presented in this work and a self-learning process for scheming a decision-making engine utilizing fuzzy logic and their membership function theory.
In this work basically focus on the implementation and development of a skin cancer screening system which can be utilized in a general practice by non-experts to ‘filter’ normal skin from the abnormalities, therefore, a patient can be discussed to a specialist. An integrated decision support system for automated melanoma recognition of dermoscopic images based on multiple expert fusions [59]. In this context, the ultimate aim is to support decision making by predicting image categories (e.g., melanoma, benign and dysplastic nevi) by combining outputs from different classifiers. A fast and automatic segmentation method to detect the lesion from the background healthy skin is proposed and lesion-specific local color and texture-related features are extracted. For the classification, combining experts which are classifiers with different structures, are examined as alternative solution instead of an individual classifier. In this approach, probabilistic outputs of the experts are combined based on the combination rules that are derived by following Bayes’ theorem. The category label with the highest confidence score is considered to be the class of a test image. Experimental results on a collection of 358 dermoscopic images demonstrate the effectiveness of the proposed expert fusion-based approach.

A smart phone based system for storing digital images of skin areas depicting regions of interest (lesions) and performing self-assessment of these skin lesions within these areas [60]. The system consists of a mobile application that can acquire and identify moles in skin images and classify them according their severity into melanoma, nevus and benign lesions. The proposed system includes also a cloud infrastructure exploiting computational and storage resources. This cloud-based architecture provides interoperability and support of various mobile environments as well as flexibility in enhancing the classification model. Initial evaluation results are quite promising and indicate that the application can be used for the task of skin lesions initial assessment.

A prototype of an image-based automated melanoma recognition system on Android smart phones [61]. Melanoma skin cancer accounts for less than 5% of skin cancer cases but causes the most deaths due to skin cancer. Convenient automated diagnosis of skin lesions and melanoma recognition can greatly improve early detection of melanomas. The prototype of an image-based automated melanoma recognition system on Android smart phones. The system consists of three major components: image segmentation, feature calculation, and classification.
It is designed to run on a mobile device with a camera, such as a smart phone or a tablet PC. A skin lesion image is converted to a monochrome image for outline contour detection. Color and shape features of the lesion are extracted and used as input to a kNN classifier. Initial experimental result shows that the system is efficient and works well on well-lighted test images, achieving an average accuracy of 66.7%, with average malignant class recall/sensitivity of 60.7% and specificity of 80.5%.

The image processing approaches such as a fuzzy inference system and a Neural Network (NN) system were utilized in this work as promising modalities for detection of various sorts of skin cancer [62]. Extracting the shearlet features from the ultrasound cancer image for detecting the normal and abnormal tissues in the affected part. The shearlet transform analyze the image and the texture metrics are analyzed in the high dimensional way. The extracted features are classified by applying the different classifiers such as the support vector machine technique. The extracted features are compared with the different feature extraction techniques such as the contourlet, curvelet and GLCM approach. The performance of the proposed system is analyzed using the experimental results in terms of the accuracy, sensitivity, specificity, predictive values. Hierarchal Neural Network get 90.67%, while utilizing neuro-fuzzy system is get 91.26% and NN sensitivity is 95% and specificity is 88%. At the same time, the skin diagnosis system using neuro-fuzzy system is getting 89% of specificity and 98% sensitivity.

The optical spectroscopy and a multi-spectral classification scheme utilizing SVM to assistance dermatologists in the diagnosis of malign, benign and normal skin lesions [63]. Initially, in this works show effective classification with 94.9% of skin lesions from normal skin in 48 patients depends on the 436 features. The various classifiers involved in the cancer recognition process which is explained as follows. There are several classification techniques like Bayesian Classifiers, Hidden Markov Model, Support Vector Machine, Self-Organization Map, Fuzzy based Approach and Neural Networks are used to analyze the different type of cancer. The traditional telemedicine across the world and this study basically focuses on modeling a designing a system and here initially collate past Pigmented Skin Lesion (ELM) in aiding diagnosis. In this work use Pigmented Skin Lesion (PSL) and analysis the images related to skin cancer.
In this work also use the computational intelligence methods to examine, classify and process the given image library. Here the use the texture and morphological feature from the given image. These results are shown in mobile data acquisition devices which in turns specify the benign (non-threatening) or malignancy (life-threatening) status of the imaged PSL. This forms the fundamental for upcoming automated classification process in term of skin lesions in skin cancer patients.

2.14 Statistical Region Merging Technique

The statistical Region Merging Method is different kinds of modules in a skin cancer automated diagnosis system which includes: classification system of an automatically skin cancer and find the association of skin cancer image with various short of Neural Networks are studied with various sorts of preprocessing approach [64]. The gathered images are feed into the proposed system, here use different image processing approach to improving the properties of given image. The Statistical Region Merging (SRM) algorithm is worked depends on the region merging and growing. After this process, the normal skin is detached from the affected skin area. Normally, information can be mined from these images and pass to the grouping system for testing and training. Two different kinds of neural networks are utilized as classifiers such as an Auto-associative neural network (AANN) and Back-propagation neural network (BPNN). Recognition accuracy of the 3- layers BPNN classifier is 91% and ANN is 82.6% in the given image database which includes adigital photo and dermoscopy photo and these experimental analyses are done by using on MATLAB.

An automatic evaluation system of human skin surface condition based on subjective evaluation provided by cosmeticians. In the proposed system, image features extracted on the skin image and subjective evaluation by cosmeticians are flexibly connected by using a Back Propagation Neural Network, so that it can automatically estimate human skin surface condition based on subjective evaluation from various skin images. Using the trained neural network, human skin surface condition based on subjective evaluation is estimated for unlearned skin images [65]. Then subjective evaluation by this system was compared with that by cosmeticians.
Since the proposed system can successfully estimate human skin surface condition like cosmeticians, the effect of the system is demonstrated. An impression of Cancers and their different kinds of techniques in image processing for distinguishing different kinds of Cancers. In this work improves the image processing mechanisms which are widely utilized in several medical areas for enhancing the treatment stages and earlier detection, particularly in various cancer tumors.

## 2.15 Data Mining Techniques

The data mining concepts and their different methods are available in the literature on medical data mining [66]. In this work mainly emphasize on the data mining application on skin diseases. A classification has been offered depends on the various kinds of data mining approach. The effectiveness of the numerous data mining procedures is highlighted. Usually, association mining is suitable for mining rules. It has been utilized particularly in cancer diagnosis. A classification is a robust approach in medical mining. In this work summarized the various kinds of classification and their using process in dermatology. It is one of the most significant approaches for diagnosis of erythematous-squamous diseases. There are different kinds of methods are available for examples like fuzzy classification, Genetic Algorithms and Neural Networks in this topic. The Clustering is a suitable technique in medical image mining. Thus, in this work investigated some experiments which exist in mining skin data. The computer vision based diagnosis system which discussed some clinical diagnosis approach which is being combined with the tool for detecting a different type of lesion process.

In epidermis area, finding the Melanocytes in the epidermis is a significant process and difficult process also. Thus, the author proposes a novel technique for detection of the Melanocytes in epidermis area [67]. The proposed technique based on radial line scanning, this process used for estimating the halo region and from all the keratinocytes has to detect Melanocytes is this process by using nuclei approach. Experimental evaluation based on 40 different histopathological images it comprises 341 is Melanocytes. Useful information can be extracted from these medical images and pass to the classification system for training and testing using MATLAB image processing toolbox for detection of dead skin.
An image-processing method applied to skin texture analysis, it considering that the characterization of human skin texture is a task approached only recently by image processing, our goal is to lay out the benefits of this technique for quantitative evaluations of skin features and localization of defects. That method based on a statistical approach to image pattern recognition. The results of our statistical calculations on the grey-tone distributions of the images are proposed in specific diagrams, the coherence length diagrams, using the coherence length diagrams, to determine grain size and anisotropy of skin textures. Maps showing the localization of defects are also proposed. According to the chosen statistical parameters of grey-tone distribution, several procedures to defect detection can be proposed. Here, a comparison of the local coherence lengths with their average values. More sophisticated procedures, suggested by clinical experience, can be used to improve the image processing. An automated system based on texture analysis is the spatial distributions of hemoglobin and melanin in human skin are divided by an independent component [68]. The texture features are obtained from Gray Level Run Length Matrices. Finally, the classification process is done by using Minimum Distance Classifier. The experimental result is using DERMNET database which contains 350 images

A novel approach for skin cancer analysis and detection from cancer affected image [69]. The image enhancement and de noising process by using Wavelet Transformation and the Asymmetry, Border irregularity, Color, Diameter (ACBD) rules are used for histogram analysis. Finally, the classification process is done by using Fuzzy inference system. The pixel color is used for determining the final decision of skin cancer type, the decision may be two stages like a malignant stage and begin the stage of skin cancer. A computer vision based skin image Diagnosis system and Initially, in this work skin, lesion segmentation process is done. After those vital steps are to mine the pattern and feature analysis processes to create a diagnosis of the skin cancer affected area. This work provides an idea to process the classification, detection, and segmentation of the skin cancer and the skin cancer affected area utilizing hybrid image processing approach.

The k-means algorithm, watershed method and the difference in strength methods [70]. Initially the image has been segmented into the different regions by using the k-means clustering approach.
From the segmented regions, the intensity value is calculated for each region and the effective boundary and edge information is obtained by the difference strength method. Finally the watershed algorithm is applied to each edge to analyze the broken lines in the entire image. From the region the tumors have been segmented with efficient manner. Then the performance of the proposed system is analyzed using the experimental results and discussions.

An intelligent automated approach for identifying the different sort of skin lesions utilizing machine learning procedures [71]. Two sorts of texture feature have been utilized to perform classification of non-melanoma and melanoma. Initially, local information is getting over the Local Binary Pattern (LBP) on various kinds of scales and GLCM at different angles has been mined as a kind of texture features. Typically, these features are robust because of scale rotation invariant property of GLCM features and invariant property of LBP. The Global information of altered colors channels has been integrated through four various moments mined in six different color space. Thus a merged hybrid texture color and local as global features have been recommended to categorize the non melanoma and melanoma. The SVM has been utilized as a classifier to classify non-melanoma and melanoma. Experiments outcome shows that the promising results when compared with other existing methods.

The optimized features by using the multi cluster feature selection method [72]. The ultrasound images are preprocessed and the 50 different features are extracted from the image. These features are difficult to process, so, multi clustered feature selection method has been applied to minimize the features and the sub set of the features are selected. The selected features are fed into the sparse representation classifier which classifies the features into the normal and malignant tumors. The performance of the proposed system is analyzed using the 504 ultrasound image which classifies the cancer into the 93.31% accuracy with efficient manner. A fungus, skin acne, allergies for example skin rashes, hives for example etching sorts of issues correlation with skin texture profile is proposed Here the skin detection is the process of recognizing skin regions and colored in an image [73]. Initially, the existing scenario and then examined the frequency domain it is taken from the frequency domain image texture and in this work additionally use gray level profile analysis.
Different kinds of methods such as log filtering, k-means, k-nearest neighbor, fuzzy-based split-and-merge algorithm (FBSM) Region refinement, adaptive snake (AS), Gradient Vector Flow (GVF) and adaptive thresholding (AT) has been utilized for melanoma segmentation images [74]. Additionally, in this work collected dataset and discusses different kinds of segmentation methods. A computer vision based skin image Diagnosis system. Initially, in this work skin, lesion segmentation process is done [75]. After those vital steps are to mine the pattern and feature analysis processes to create a diagnosis of the skin cancer affected area. This work provides an idea to process the classification, detection, and segmentation of the skin cancer and the skin cancer affected area utilizing hybrid image processing approach.

2.16 Texture Image Technique

Analyses the skin texture analyzed by an image analysis Technique with computer assisted. It is very useful for creation and invention of cosmetic products [76]. There are some methods needed to analyze the skin. The objective of this study was to analyze the texture of the human skin by image processing method. In order to do so, the research was done by first preparing the replica of the human skin, and hence the skin image was obtained by taking the projection of the replica by image grabber. Image processing analysis was done to measure the skin roughness parameter. The result shows that the software can display the image and calculate the skin parameters.

The Skin cancer classification system and the relationship of the skin cancer image across different type of neural network is established [06]. It is an extremely bulky process to predict a disease based on the visual diagnosis of cell type with precision or accuracy, especially when multiple features are associated. If get the information about the dead skin which is not visible by naked eyes well in time then it can easily prevent the further spreading of disease on the other part of body. One of the major problems coming in the medical field is that doctors are not able to detect that infected part which is not visible by naked eyes and therefore they only operate the visible infected part of the skin and this may cause a major problem like cancer or any dangerous disease in the future. The collected medical images are feed into the system; using different image processing schemes image properties are enhanced.
2.17. Dataset Used

In our research work, skin cancer images are used for skin Melanocytes classification. Online dataset images are used for both training phase and the testing phase. The data set contains the three types of skin cancer images such as Malignant Melanoma, Basal Cell Carcinoma and Squamous Cell Carcinoma. There are three types of online datasets are used in our research work like ISIC (International Skin Imaging Collaboration), Dermnet, Dermatlas [79]. Totally two thousand images are involved. Both training and testing phases are used that images. The images are split for training and testing using N- fold methodology. The sample skin cancer images are shown in Fig 2.1

Figure 2.1 Sample Skin Cancer Images