CANCER DETECTION TECHNIQUES - A REVIEW

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Abstract - *Cancer is one of the most dangerous diseases that cause death. Cancer is not one disease. It is group of more than one different and distinctive diseases .There are various types of cancers such as Lung cancer, Breast cancer and Skin cancer etc. The skin cancer is abnormal growth of skin cells most often develops on body exposed to the sun light but can occur anywhere on the body. Skin cancer is most common type of malignancy for both men and women. So, for the detection of cancer, image processing techniques plays an important role. There are mainly four steps involved for the detection of skin cancer that are: Pre-processing, segmentation, feature extraction and classification. Acquisition, removal of noise, image enhancement handled in pre-processing. The step, in which the image is divided into different sections, generally called image segmentation and the different features are extracted and cancerous cells are classified through different classifier. This paper represents the analysis on the different methods of detection of skin cancer .*

Key words: Skin diseases, image pre-processing, image segmentation, Feature Extraction, Classification.

1. INTRODUCTION

Cancer is one of the most dangerous diseases that cause death. Cancer is not one disease. It is group of more than one different and distinctive diseases .There are various types of cancers such as Lung cancer, Breast cancer and Skin cancer etc. Skin cancer is most common type of malignancy for both men and women. The human body have biggest organ called skin. It isolates the inward parts of body and furthermore frames external condition. The skin is significant organ which shield body from the sensitivity, infections, contamination, microorganisms and it likewise controls the temperature of body. There are numerous side effects like swelling, consuming, redness and tingling which can change or harm the surface of skin. They might be caused by sensitivities, aggravations, hereditary issues and invulnerable framework issues. Every one of these side effects can bring about various diseases like skin break out, alopecia, dermatitis, and ringworms causing mutilation in look and feel of individual concerned. Diseases, for example, growth identified with Skin can be caused by numerous unmistakable reasons [1].

The skin cancer is abnormal growth of skin cells most often develops on body exposed to the sun light but can occur anywhere on the body. It develops when an unrepaired DNA damage to the skin cells and mostly caused by ultraviolet radiation of the sun or tanning beds, trigger mutations (genetic defects) which leads to the skin cells multiply rapidly and malignant tumors form. Some skin cancer can spread and cause damage in the nearby tissue cells [2]. Sun is the most common cause of skin cancer. But it fully does not explain that skin cancer usually develop on the skin exposed to sunlight. Also it can be exposed to environmental threats, radiation analysis, and even inheritance could play a role. [3].

Risk Factors of any skin cancer

1. **Sunlight:** Sunlight is a source of UV radiation. It's the most important risk factor for any type of skin cancer. The sun's rays cause skin damage that can lead to cancer.

   a) **Severe, blistering sunburns:** People who have had at least one severe, blistering sun burn are at increased risk of skin cancer. Although people who burn easily are more likely to have had sunburns as a child, sunburns during adulthood also increase the risk of skin cancer.

   b) **Lifetime sun exposure:** The total amount of sun exposure over a lifetime is a risk factor for skin cancer.

   c) **Tanning:** Although a tan slightly lowers the risk of sunburn, even people who tan well without sun burning have a higher risk of skin cancer because of more lifetime sun exposure.

2. **Sunlamps and tanning booths:** Artificial sources of UV radiation, such as sunlamps and tanning booths, can cause skin damage and skin cancer. Health care providers strongly encourage people, especially young people, to avoid using sunlamps and tanning booths. The risk of skin cancer is greatly increased by using sunlamps and tanning booths before age 30.

3. **Family history:** Melanoma sometimes runs in families. Having two or more close relatives (mother, father, sister, brother, or child) who have had this disease is a risk factor for developing melanoma. Other types of skin cancer also sometimes run in families. Rarely, members of a family will have an inherited disorder, such as xeroderma pigmentosum or nevoid basal cell

carcinoma syndrome, that makes the skin more sensitive to the sun and increases the risk of skin cancer.

4. **Skin that burns easily:** Having fair (pale) skin that burns in the sun easily, blue or gray eyes, red or blond hair, or many freckles increases the risk of skin cancer.

5. **Certain medical conditions or medicines:** Medical conditions or medicines (such as some antibiotics, hormones, or antidepressants) that make your skin more sensitive to the sun increase the risk of skin cancer. Also, medical conditions or medicines that suppress the immune system increase the risk of skin cancer.

The sign of skin cancer often starts as the change of color in the skin. They are usually mixed color (pink, red, and brown). There are three types of skin cancer that occurred. They are- Basel cell cancer, squamous cell carcinoma and malignant melanoma tumor. The first two does not spread quickly, but the third one spreads quickly. Melanoma is much less common than basal cell and squamous cell skin cancer, but it is far more dangerous than the other two types. However, it is much more dangerous if it is not found early. It causes the majority (75%) of deaths related to the skin cancer [4]. When melanomas occur, they usually arise from pigmented nevi (moles) that are large (diameter greater than 6mm), asymmetric, with regular borders and coloration. Bleeding, itching and a mass under the skin are other signs of cancerous change.

1.1 Different Existing Imaging techniques for the diagnosis of skin cancer

A. Expert System for Diagnosis of Skin Diseases

The spread of diseases in human body is normal. The disease, for example, tumor can without much of a stretch spread through the use of association. Such diseases must be identified at beginning time with the goal that treatment is conceivable. In the event that disease spread past certain level then they can't be cured. Master framework has been formulated which can be utilized as a part of request to give strategy for identification and recommend cure. This framework required the client to enter the side effects and after that store is utilized to think about inputted parameters against inputted parameters. The outcome is being anticipated to the client. The framework additionally proposed the medical aid and close-by medicinal services focuses. Strategies like information mining and picture preparing are utilized as a part of request to decide the issues. The graphical user interface is used with the goal that client does not need to sort extensive summons keeping in mind the end goal to work on the framework. As such simple to utilize interface is given for this situation [5].

B. An effective framework computerization for skin disease distinguishing proof

The skin diseases are normal among youthful and old group. This could likewise bring about plagues. Procedure has been formulated with a specific end goal to handle such circumstance. The looked into procedure known as dark standardized symmetrical concurrent event stencils (GLCM-Gray level co-occurrence matrix) which proficiently handles and propose cure for skin diseases show inside the human body. The value of such framework is savvy approach. Restorative determination through this strategy brings about minimum blunders [9]. Highlight extraction is additionally upheld subsequently multifaceted nature related with this framework is likewise lessened. The graphical interface is given with the goal that guileless clients can likewise use such framework.

C. Identify skin diseases through different procedures of Picture handling

The different procedures of picture handling like separating, include extraction, segmentation are used to identify these skin diseases. The picture preparing strategies are connected just on advanced picture so we have to change over picture into computerized shape. This advanced picture is utilized to get important data or to get enhanced picture by performing capacities onto picture. So we can state that it is the flag preparing in which input a picture and the yield additionally another picture is having same properties of information. Picture preparing is broadly utilized innovation that take input tests as 2-D signals and after that they apply settled flag handling techniques to them [7].

D. Magnetic resonance Imaging

MRI used for diagnosis the cancer. The strength of MRI are obtaining information on the depth and extent of the underlying tissue involvement and can be used to measure melanoma thickness or volume. But this system has weakness is the need for sufficient resolution and adequate number of images per sequence for discriminating skin lesions [15][16].

E. Mobile based applications to distinguish skin diseases inside living things

Development of innovation and rise of fifth era PCs help in settling issues of human services. Picture handling is one such range in which manmade brainpower is consolidated. Procedures of AI can be utilized as a part of request to make applications in view of mobiles. The client makes IDs in the application and after that info the parameters identified with the disease [6]. Client will get the applicable data about the disease in a hurry. The picture can likewise be inputted to recognize the diseases inside the human body. The parameters are extricated through

the utilizations of highlight extraction. In view of the parameters result is created and given to the client. The examined paper recognizes 6 particular diseases. The exactness of such framework is likewise very high. The investigated paper introduces the consequence of 90% precise and verified data.

F. Skin Disease recognition through examination of shaded pictures

Shaded pictures are incredible wellspring of giving data particularly in the restorative field. The restorative pictures can be dissected by the use of reviewed paper. The shading pictures can be removed with the goal that skin diseases can be plainly distinguished. Number of methods are accessible and are utilized as a part of this respect. Most normal strategy used is known as histogram identicalness. The technique depends on the upgrade of complexity keeping in mind the end goal to decide the strange part of the skin [10]. The skin diseases can be effectively distinguished by the utilization of investigated system. Shading based picture recovery is another strategy used to separate the data from the picture. Highlight vector is used to remove the highlights to feature the mutilated piece of the picture in this system. The movement sensibility and light source issues are absent for this situation. Consequently this strategy is sufficiently proficient to deal with the clamor issues promotion recognize skin diseases if any inside the human body. The outcomes demonstrates that this method is diversed enough to deal with clamors and give better outcome as far as skin diseases.

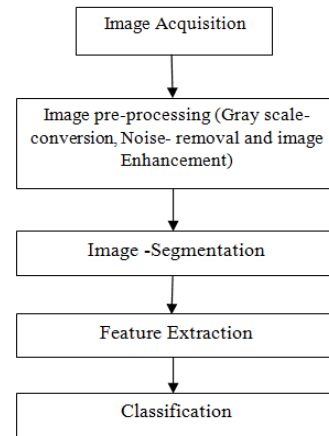## 1.2 Steps of Detection of Skin Cancer

For the detection of skin cancer four major steps involves: Image Pre- processing, Image segmentation, Feature-extraction and Classification.

a) Image Pre-Processing:-Goal of pre-processing is an improvement of image data that reduces unwanted distortions and enhances some image features further image processing. Image pre-processing involves three main things:

1. Gray scale Conversion:- In Grayscale conversion color image is converted into the grayscale image. Grayscale image contains only brightness information. Each pixel value in Grayscale image corresponds to an amount of light. Grayscale image measures only light intensity. 8-bit image will have brightness variation from 0 to 255 where '0' represents black and '255' represents white.

2. Noise Removal:- The objective of noise removal is detect abd remove the unwanted noise from digital image. Noise is random variations in the pixel values. Different filters

like Median filter, Mean Filter and adaptive median filters etc. are used for noise removal.

3. Image Enhancement:- The objective of image enhancement is to process an image to increase the visibility of feature of interest like Contrast of an image.

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│    Image Acquisition     │
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┌─────────────────────────┐
│ Image pre-processing (Gray scale-│
│ conversion, Noise- removal and image│
│      Enhancement)       │
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┌─────────────────────────┐
│    Image -Segmentation   │
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│    Feature Extraction    │
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│      Classification      │
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b) Image Segmentation:-In computer vision, segmentation refers to the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels).Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, texture. All image processing operations generally aim at a better recognition of objects of interest, i.e. at finding suitable local features that can be distinguished from other objects and from the background. The next step is to check each individual pixel to see whether it belongs to an object of interest or not. This operation is called segmentation and produces a binary image.

Different Segmentation techniques

1. Thresholding:- Thresholding is one of the easiest method of segmentation where a gray scale image is transformed into Binary image. Determining threshold and then the pixels are divided into groups based on that criterion. It includes bi-level and multi-thresholding.

2. **Region-based segmentation:-** Splitting the image into smaller components then merging sub images which are adjacent and similar in some sense. It includes Statistical region merging, multi scale region growing, and morphological flooding.

3. **Edge based segmentation:-** This technique selects weather the pixels of an image belong to the edge or not. The existence of weak edge in the images resulting from a smooth transition between lesion and skin is the main problem behind the edge based approach. Another drawback of this is the presence of noise points in the image can be derived from some image artifacts like hairs air bubbles and skin lines.

4. **Soft computing:-** Methods involve the classification of pixels using soft computing techniques including neural networks, fuzzy logic, and evolutionary computation.

c) **Feature Extraction:-**The Image Features Extraction is very important image processing technique which used to detect and isolate various desired portions or shapes (features) of an image. After the segmentation is performed on image, the features can be obtained from it and the diagnosis rule can be designed to exactly detect the cancerous part of skin. The purpose of feature extraction is to reduce the original data set by measuring certain properties, or features, that differentiate one input pattern from another. The feature extraction is performed by measurements on the pixels that represent a segmented object allowing various features to be computed. For the diagnosis of Melanoma, followed by ABCD rule, Pattern Analysis and 7-points checklist. The parameters used as:

1. **Area:** Area is a scalar quantity. It is actually total of number of pixels identified in that extracted tumor.

2. Perimeter: This is a scalar quantity. It is the total number of boundary pixels found in connected component of tumor.

3. Eccentricity: It mainly decides the circularity of identified tumor. Minimum the eccentricity less circular will be the identified tumor and wise versa [17].

d) **Classification:-**After feature extraction we have to classify features into cancerous and non-cancerous types. Following some methods are used for classification:

1. *K*-**Nearest Neighbour Algorithm (KNN):-** The *K*-nearest neighbor classifier is a non parametric method of pattern recognition. For a lesion belonging to the test set (query vector), it is found that the *K* vectors are the closest to the query vector in the training set. The unclassified sample is then assigned to the class represented by the majority of the *K* closest neighbours. The most critical requirement of the*K*-nearest neighbor classifier is to have a training set including enough examples of each class of pigmented lesions to adequately represent the full range of measurements that can be expected from each class. Optimizing the procedures of feature selection and weight definition could additionally improve the performance of the *K*-nearest neighbour classifier.

2. **Support Vector Machines (SVM):-** Support vector machines (SVMs) are a machine learning paradigm based on statistical learning theory. With SVM each data item is plotted as point in n-dimensional space where n is number of features. SVMs have several advantages over the more classical classifiers such as decision trees and neural networks. The support vector training mainly involves optimization of a convex cost function. Therefore, there is no risk of getting stuck at local minima as in the case of back propagation neural networks.

3. **Decision Trees:-** The decision tree approach belongs to the supervised machine learning techniques. It is popular for its simplicity in constructing, efficient use in decision making, and simple representation, which is easily understood by humans. This algorithm repeatedly splits the data set according to a criterion that maximizes the separation of the data, resulting in a tree-like structure.

4. **Artificial neural network (ANN):-** ANN is one of the great vital parts of soft computing. The ANN consists of several small processing units (the artificial neurons) that are highly interconnected. The supervise ANN is an iterative process which requires many presentations of the training set; the system is said to learn from examples. It has conspicuous capacity to obtain idea from complex data and is used to take out patterns and determine trends that are too difficult to be noticed by humans or any other computer skills. Neural network is capable to solve highly complex tasks due to the nonlinear processing capabilities of neurons.

2. LITERATURE REVIEW

Chandrahasa M, Varun Vadigeri and Dixit Salecha [11] proposed a method of Detection Of Skin Cancer Using Image Processing Techniques. The system uses skin cancer can be detected in early stages using smartphone application by analyzing properties of the cancer, Asymmetry, Border, Color variation, Diameter and Expansion(ABCDE).These properties are analyzed using different image processing techniques like Grey scale conversion, Segmentation, contour tracing and histogram analysis.

Sujaya Saha, Dr. Rajat Gupta et.al [12] proposed An Automated Skin Lesion Diagnosis by using Image Processing Techniques. The different digital lesion images have been analyzed based on unsupervised image acquisition, pre-processing, and image segmentation techniques. Then the Feature extraction techniques are applied on these segmented images. After this, a graphical user interface has been designed for the lesion probability detection.

Palak Mehta and Bhumika Shah et.al [9] proposed a computer aided techniques for analysis of skin cancer. Segmentation of picture through different methods such as thresholding, Fuzzy- C Mean (FCM) provides the accurate results. This strategy is capable of police investigation regions inside the picture.

Bhuiyan, Azad, Uddin et.at [18] shows the image processing for skin cancer feature extraction. The different digital image are analysed through unsupervised segmentation techniques such as Otsu's method, Gradient Vector Flow (GVF), Color Based Image Segmentation Using K-mean Clustering. Otsu's method gives best segmentation

REVIEW ANALYSIS ON THE TECHNIQUES USED FOR SKIN CANCER

Procedures to distinguish the skin issues like tumor and other destructive diseases are numerous.

Each having their advantages and disadvantages. The examination of different systems are portrayed through unthinkable structure as Table 1.

They uses different methods Thresholding, region based, pixel based and model based. ABCD rule extracted the different features and classified the features through fuzzy and neural network.

Sumithra R, Mahamad Suhil, D.S. Guru et.al [8] define skin lesions analysis by use of segmentation and classification. Segment the image based on region(pixel). Different features are extracted through color, texture, RGB histogram and define the cancerous and non-cancerous through SVM (Support vector machine) and KNN (K-Nearest Neighbours). This system complex than other.

Mahmoud and Al-Jumaily et.at [7] proposed Neural network based approach for detection of skin cancer using wavelet and curvelet system. Back Propagation method is utilized for enhanced work. This system provide highest accuracy results for curvelet with BNN of two layer. But this difficult to implement.

M. Garbaj and A.S. Deshpande et.at [14] shows the visual options for skin cancer detection. They analyzing the Dermoscopy pictures because the extraction of borders of skin lesion provides important clues for correct destination.
results. Features are extracted based on the Otsu's segmentation through ABCD-rule.

Z. A. Mdaghri et.al [13] talked about the clinical assurance of melanoma could be hard for a general master and, now and again dermatologists utilize PC supported conclusion for the skin injury determination. The demonstrative calculations ADAM indicates higher symptomatic execution as Compared with the doctors, as far as affectability and a lower one as far as specificity.

Techniques	Classes	Method	Features	Classifiers	Strength	Weakness
Computer Aided techniques for analysis of skin diseases	Melanoma	Threshold base Region based Pixel based Model based	Asymmetry Border Color Dermoscopic Structure or Diameter	Techniques of artificial intelligence including fuzzy, neural network	Gives better result as compared to existing system	Entropy is missing
Skin lesions analysis by the use of segmentation and classification technique	Melanoma and distinct categories of skin cancer	Region Based (pixel based)	Color, Texture, RGB histogram(describes color context of the image)	Support vector Machines, k-NearestNeighbour.	Fusion based classifier(SVM -KNN)	Complex
Image processing techniques to analyze	Melanoma	Automatic interface with	Texture and size analyses. feature	Melanoma cancer detection using	Graphical interface is provided	Prone to error

skin cancer(Melanoma)and other problems associated with skins		minimal user interaction, Threshold mechanism to provide clarity of result	extraction , Geometry analysis like area , width etc	rule based system		
A Bag-of-Features Approach for detection of cancer through colored image analysis	Melanoma	-------	Color And Texture Descriptors Gray Level Co-Occurrence Matrix (GLCM)	ABDC rule 7-point checklist Menzies' method	Color image analysis is performed better as compared to existing approach.	testing sparse sampling methods are not utilizes
The Beneficial approach for analysis of colored images to detect skin cancer	melanoma	Image enhancement Image restoration	Mean filters Adaptive filters Order statistics filters Scaling and contrast enhancement such as histogram equivalence is utilized	--------	designing the automatic skin cancer detection system	Does not focus on filters
Distinction between various filters utilized in order to detect skin cancers	Skin cancer images	Image enhancement Image restoration	Mean filters Adaptive filters Median filter Gaussian smoothing filter Salt & Pepper noise Adaptive Wiener filter	------------	Distorted image is smoothen by the use of suggested filters	Only focus on filtering
Neural network based approach for the detection of skin cancer	Melanoma	Region based extraction and threshold mechanism are utilized to generate optimal performance	Modular strategy and region free approach	Back propagation mechanism is utilized for enhanced work.	the result achieved with highest accuracy forCurvelet with BNN of two layers. Mixture of noises are detected and handled by the tools specified. Mainly demographical images are handled by the use of suggested techniques.	Not easy to implement
Segmentation approach to detect skin problems within human body	skin cancer and wound	Image segmentation based on edge accuracy' EAC. And Surface accuracy model is utilized	Infected skin along with edges are detected using this strategy	K-means segmentation FCM algorithm IFCM clustering algorithm Otsu's method Active contour	Allow demographist to detect disease in least time consumption methodology	Less accuracy
Automated approach to detect skin lesions through segmentation	Skin Lesion Images	Evolutionary Strategy (Es) Es-Based Algorithm For Lesion	Region of interest technique along with texture analysis	Fuzzy c-mean. Sigmoid PCT PCT plus Sigmoid	More robust algorithm which is not affected by noise introduction	More Time consumption
Automated Melanoma Recognition	Melanoma	region-based segmentation	Color and texture parameters, area, perimeter, Size, Shape descriptors	Mechanism of threshold, c means clustering etc is utilized	Performance of segmentation is better as compared to earlier approaches	Not easy to identify using manual test
Segmentation of skin cancer images	melanoma and non-melanoma	Double thresholding , Elastic curve, Region refinement	Boundary extraction Pigmented lesion Gaussian noise is handled and image is smoothens		Automated approach is followed to detect skin diseases with minimal user interaction	Dermatologist suggestion are must for detection of skin disease

3. CONCLUSION

Cancer is most dangerous and widespread disease in the world. Incident rates of melanoma skin cancer have been rising since last two decades. So, early, fast and effective detection of skin cancer is paramount importance. In this paper, analysis on the different diagnosis techniques for skin cancer has been done .This gives best in class examination between the particular systems used to recognize skin issues. A large portion of the methods investigated manages skin diseases like Melanoma. Through the examination table proficient approach can be identified and used so better outcomes can be accomplished in identification of skin issues. Future degree exists as no innovation guarantees 100% precision of identification. Additionally skin diseases which can be identified through dissected methods are restricted.

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