Skin Cancer Detection Using Convolutional Neural Network (CNN)

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[1] ***Abstract***

Worldwide cancer patients are increasing, Skin Cancer is one of most spreader type of cancer. Early skin cancer identification is crucial and can help prevent some skin cancers, and because of the high expense of treatment, quick growth rate, and mortality rate of melanoma skin cancer. The majority of the time, treating cancer cells requires time and manual detection. Although there is a lot of work in this field, but a few have targeted offering solution within mobile applications which is need by many patients as a primary disease discovery. The proposed solution is to combine both efforts. First the deep learning method convolution neural network (CNN) and image processing strategy for an artificial skin cancer diagnosis system which was used to detect the type of skin cancer, with using of the ISIC2018 dataset, with transfer learning model InceptionV3 which was used for fine-tuning. Secondly Mobile Application has developed with the proposed detection technique to help patients in initial examination for Skin Cancer, and facilitate the process of follow up with medical team. The results shows an accuracy rate was 85.8% in skin cancer detection.

Index Terms—Skin Cancer(SC), Machine Learning(ML), Artificial Neural Network (ANN), Convolutional Neural Network (CNN).

1) INTRODUCTION

Nowadays The prevalence of cancer patients is rising as a result of several reasons, including lifestyle choices like drinking alcohol and using nicotine, as well as environmental changes like sun exposure and other forms of radiation. Skin Cancer (SC) is one of the most typical types of cancer. It may be the cause of unusual cellular swellings on the skin. [1] Skin cancer is defined as an abnormal growth of skin cells and often occurs when the skin is exposed to harmful sunlight, but it can occur in different areas of the body that may not normally be exposed to sunlight.[2]

Skin cancer is also caused by a mutation in the DNA of D.N.A for healthy skin cells. The mutations promote uncontrolled cell growth, which leads to the formation of a mass of malignant cell strains.

Skin Cancer begins in the dermis, the thin layer that provides a protective covering for the skin cells in the body. The dermis contains three main types of cells, all of which have a high prevalence and appearance, although skin cancer can be prevented and the bulk of it prevented by limiting or avoiding unnecessary exposure to ultraviolet rays, and by paying attention to suspicious and suspicious changes that appear in the skin. [1],[5].

Through early detection, it has high rates of success that can be achieved in treating most cases of skin cancer, including the most aggressive and deadly forms and types[8].

Factors that may increase the threat of skin cancer include :

1) Light complexion, Anyone can develop skin cancer, anyhow the color of the skin. Still, having a minor pigment(melanin) in the skin provides lower protection from UV rays. However, it tends to patch and sunburn fluently, If you have golden, red hair or light eyes.
2) History of sunburn, The threat of developing skin cancer increases after puberty, if you had one or further blistering sunburns during nonage or in the teenage time. Sunburn in the majority is also a threat factor, Those who reside in sunny and high-temperature places are more exposed to sunburn than those in cooler places. Living in advanced elevations, where the sun's shafts are most violent, also exposes you to further radiation. [8].

Utmost skin cancers can be averted. To cover yourself from skin cancer, follow these tips: 1) Avoid the sun during the noon period, the sun's shafts are strongest between 10 a.m. And 4 p.m, so Schedule out-of-door conditioning for other times of the day, indeed in downtime or when it's cloudy. 2) Use sunscreen all time round, Sunscreens do not block all of the dangerous UV shafts, especially the radiation that can lead to carcinoma, But it plays a crucial part in a comprehensive sun protection program. 3) Use broad-diapason sunscreen with an SPF of at least 30, indeed on cloudy days. Apply sunscreen freely and reapply at least every two hours or more frequently if you are swimming or perspiring. Use a generous quantum of sunscreen on all exposed skin, including your lips, the tips of your cognizance, and the tails of your hands and neck. [1][7].

On your body whether in otherwise healthy skin or an existing malignant, melanoma can grow. Melanoma most frequently appears on the face of the affected men. In women, this type of cancer continually develops on the lower legs. Carcinoma can develop on skin that hasn't been exposed to the sun in both genders and afflict any skin tone. In people with darker skin tones, carcinoma tends to do on the triumphs or soles, or under the fingernails or toenails.

Carcinoma symptoms include : a huge brown area with darker flecks, a tumor that bleeds, changes in size, or color, and a small lesion with an uneven border Dark lesions on your triumphs soles and fingertips with a painful lesion that itches or burns along the border and in the areas that are red, pink, white, blue, or black. In toes, or mucous membranes lining your mouth, nose, vagina, or anus[5].

Kaposi sarcoma is one of several very uncommon kinds of skin cancer, this unusual kind has symptoms of red or grandiloquent patches of skin or mucous membranes are signs of cancer that grows in the skin's blood vessels and causes red or grandiloquent spots on the skin. Kaposi sarcoma substantially occurs in people with weakened vulnerable systems, similar to people with AIDS, and in people taking specifics that suppress their natural impunity, similar to people who've experienced organ transplants. Young African men as well as older Italian or Eastern European Jewish men are at higher risk of developing Kaposi.

Merkel cell melanoma causes shiny nodules that occur on or just beneath the skin and in hair follicles. Merkel cell melanoma is most frequently set up on the head, neck, and trunk.

Sebaceous gland melanoma, This aggressive cancer originates in the oil painting cell lines in the skin. Sebaceous gland lymphomas which generally appear as hard, effortless nodes (can grow anywhere), but utmost do on the eyelid.Not all skin changes are caused by skin cancer, doctors will probe your skin changes to determine a cause.

Cells involved in skin cancer: The epidermis, the above layer of your skin, is where skin cancer starts. The epidermis is a thin subcaste that provides a defensive cover of skin cells that your body continually sheds[8].

The epidermis contains three main types of cells :

1)Scaled cells lie just below the external face and function as the skin's inner filling. 2) rudimentary cells, They sit below the scaled cells and form new skin cells. 3)Melanocytes — which produce melanin, the color that gives skin its normal color— are located in the lower part of your epidermis.

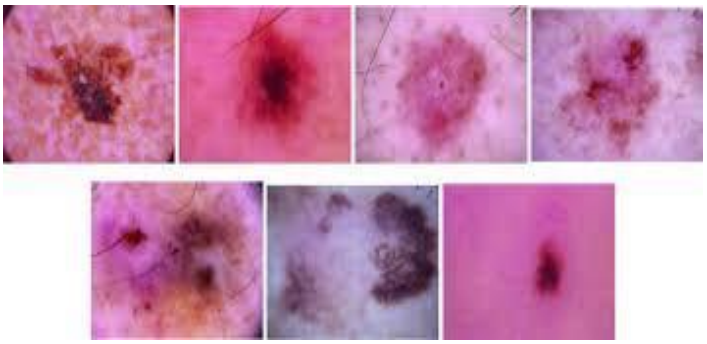
The paper is organized as follows. In section 2 Literature review, In section 3 Analysis and Discussion, In section 4- Conclusion.

2) LITERATURE REVIEW

2.1) Artificial Intelligence

The simulation of natural intelligence processes by machines particularly computer systems is known as artificial intelligence. Natural language processing, speech recognition, and machine vision are some of the specific AI processes. Frequently what they relate to as AI. Similar to Machine Learning, AI requires a foundation of technical tackle and software for jotting and training machine learning algorithms. Not a programming language is synonymous with AI, but many including Python, R, and Java are popular[2].

ML is a specific branch of AI, Its conception is innovated on the capability of machines to learn by themselves, rather than humans tutoring computers everything they need to know. This allows machines to imitate and acclimatize mortal- suchlike behavior. ML apps are Facebook and mobile facial recognition, product recommendations by Amazon, and Google maps indicating the fastest route. ML styles are generally divided into supervised and unsupervised learning algorithms, Neural networks are a type of learning algorithm which forms the base of utmost deep learning styles[2].



2.2) Skin Detection.

The technique of looking for skin-colored pixels and areas in an image or videotape is called "skin discovery.". This process is generally used as a preprocessing step to find regions that potentially have mortal sides and branches in images. For skin discovery, several computer vision techniques have been created. A skin sensor typically converts a given pixel into the appropriate color space and classifies the pixel as skin or nonskin using a skin classifier[3].

The introductory way that AI in facial recognition works is that you begin with a tagged point set. You're starting with prints that have hand-matched correlations to the people involved. Skin Discovery is like it too Healthcare has advanced as a result of AI, with some studies indicating that ML-based picture recognition technologies can classify skin cancers as successfully as mortal experts[2].

National Health Service has been exploring AI to support dermatologists in triage cases with skin lesions. Mortal Skin Discovery is one of the most applicable styles in mortal discovery. The idea of this work is to give an accurate and effective system to descry mortal skin in images. The suggested method may localize a 23 region of interest (ROI) that incorporates skin pixels using the RGB and YCBCR color spaces.

This system consists of three steps, In the first stage, pre-processing an image like normalization, detecting skin range from the dataset…etc, is done. In the next stage, the proposed system detects the candidate's pixels that are in the range of 26 skin color. In the third stage, the use of a classifier decreases unwanted pixels and areas to dwindle the delicacy of the region. The results show 97% perceptivity and 85% particularity for 28 support vector machine classifiers [5].

Skin and non-skin area in 2D space(green and red), The machine learning algorithm erected by Skin Analytics, Deep

Ensemble for the Recognition of Malignancy(DERM), recognizes the most common nasty,pre-malignant, and benign skin lesions. This includes carcinoma, the most dangerous of the common skin cancers[2].

Nearly all results for the recognition of skin cancer in images take an analogous approach using a being ‘pre-trained ’ neural network and retraining it using data on skin abnormalities. These "pre-trained" neural networks like the ones developed by Microsoft Research and Google are intended to carry out distinctly different jobs, similar to large-scale image recognition(classifying 1000s of image orders, similar to pussycats, tykes, and beacon- posts), While the use of this approach gives a reasonable performance for original evidence-of- conception, a result of this type is shy for deployment in a medical device[5].

Skin Segmentation is extensively used in biometric operations similar to face discovery, face recognition, face shadowing, and hand gesture recognition. Still, several challenges such as nonlinear illumination, outfit goods, particular interferences, race variations, etc., are involved in the discovery process performing to the inefficiency of color-grounded styles. Indeed though numerous ideas have formerly been proposed, the problem has not been satisfactorily answered yet. In this paper, a form that solves some of the shortcomings of the earlier workshop is introduced. The proposed algorithm consists of three main steps including original seed generation of skin chart, segmentation in color images, and eventually a two-stage prolixity. The original seed of skin pixels is handed grounded on the idea of ternary image as there are certain pixels in images that are associated with mortal complexion There is a very good chance that the segmentation is used to find homogeneous zones using multiple color channels. The result accompanied by the edge chart of the image is employed in two successive prolixity ways to add originally unidentified skin pixels to the seed[4].

With special attention to the image-processing operation, machine vision, image processing, and ML algorithms have more important places in day-to-day functioning. Skin discovery can be extensively used for face discovery, mortal discovery, etc. In this paper, an approach 201 for mortal skin discovery is proposed, by enforcing morphological driver and SVM 202 styles. At first, the morphological driver was used to descry a region that contains mortal skin pixels, and it was cut to reduce the size of the image. The reduced image is suitable input for the classification. In the coming stage, SVM is used to increase accuracy and drop noise and unwanted pixels [6].

3) PROPOSED METHODOLOGY

The objective of this paper is to help patients to discover their condition of skin cancer and to facilitate communication with doctors within an app with interactive features. The main feature is skin cancer detection, the process followed is :

As shown in figure 1, the first stage is the dataset, the one used in this approach ISIC Dataset, next step is pre-processing for images such as normalization, segmentation shown in figure 3, followed by feature extraction from enhanced images, then applying Convolutional Neural Network.

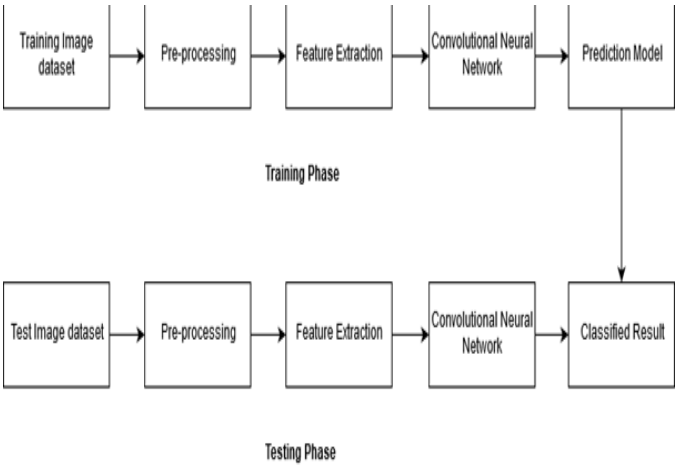


Figure 1: The Proposed Methodology Process

3.1-ISIC Dataset

ISIC 2018 is widely used in research of skin cancer [9][10][11]. The purpose of Dataset ISIC, an artificial collaboration between academic institutions, is to facilitate the use of digital skin imaging. To help reduce carcinoma mortality. When honored and treated in its foremost stages, carcinoma is readily curable. Digital images of skin lesions can be used to educate professionals and the public in carcinoma recognition as well as direct aid in the opinion of carcinoma through teledermatology, clinical judgment, and automated opinion. ISIC works to achieve its pretensions through the development and creation of norms for digital skin imaging and by engaging the dermatology and computer wisdom communities toward bettered diagnostics The first dataset which was ‘ ISIC 2018 ’ contains 10,015 images of 7 types of skin lesion conditions videlicet: Benign Keratosis, Dermatofibroma, Vascular Lesion, Melanoma, Melanocytic Nevus, rudimentary Cell Melanoma, and Actinic Keratosis. These images were collected with the blessing of the Medical University of Vienna and the school of Queensland. All the images are in the standard size of 600 × 450 pixels in JPEG, the alternate dataset which was ‘ ISIC 2019 ’ contains 25,333 images of 8 types of skin lesion conditions videlicet: Dermatofibroma, Vascular Lesion, Scaled Cell Melanoma, Melanoma, Melanocytic Nevus, rudimentary Cell Melanoma, Actinic Keratosis, Benign Keratosis. All images are in the size of 1022 × 767 pixels in JPEG format A new dataset was created by combining both the datasets of ISIC 2018 and ISIC 2019. The common classes of skin lesions were retained as shown in figure 2.

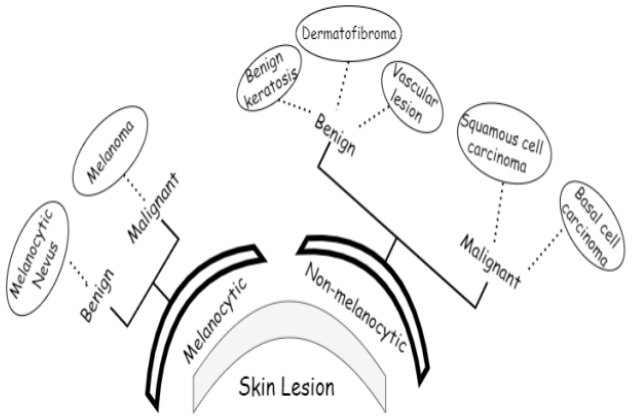


Figure 2: Isic Dataset Classes

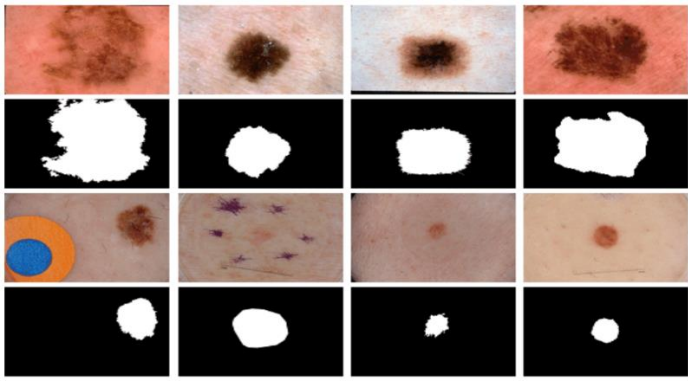


Figure 3: preprocessing of skin lesion

3.2-Inception v3

Inception-v3 is an advancement in the use of label smoothing for factorized 7 x 7 convolutional neural networks which armatured from the inception family, the propagation of label information down the network via an additional classifier, batch normalization, for layers in the side head[1],[7].

Inception V3 by Google is the 3rd interpretation in a series of Deep Learning Convolutional infrastructures. Inception V3 was trained using a dataset of 1,000 classes from the original imagenet dataset which was trained with over 1 million training images, the tensorflow interpretation has 1,001 classes which are due to a fresh" background' class not used in the original imagenet. Inception V3 was trained for the imagenet Large Visual Recognition Challenge where it was the first runner-up[7].

● What makes the Inception V3 model better?

The inception V3 is just the advanced and optimized interpretation of the inception V1 model. The Inception V3 model employed a variety of techniques to improve the network for improved model adaptation.

● It has advanced effectiveness

● It has a deeper network compared to the Inception V1 and V2 models, but its speed is not compromised.

● It's computationally less precious.

● It uses supplementary Classifiers as regularizes.

3.3- Convolutional Neural Network

To interpret data with a grid pattern, such as photos, CNN is a form of deep learning model. CNN was created with the animal visual cortex in mind and is intended to automatically and adaptively learn spatial hierarchies of characteristics, from low- to high-level patterns. Convolution, pooling, and fully linked layers are the three types of layers (or "building blocks") that make up a standard CNN. Convolution and pooling layers in order one and two do feature extraction, whereas a fully connected layer in order three maps the extracted features into the output, such as classification. In CNN, which is made up of a stack of mathematical operations, including convolution, a specialized kind of linear operation, a convolution layer is crucial. Since a feature may appear anywhere in a digital image, the pixel values are stored in a two-dimensional (2D) grid (figure 4), or array of numbers, and a small grid of parameters called the kernel, an optimizable feature extractor, is applied at each image position, making CNN extremely effective for image processing. Extracted features may gradually and hierarchically become more sophisticated as one layer feeds its output into the following layer. Training is the process of minimizing the difference between outputs and ground truth labels using an optimization technique like backpropagation and gradient descent, among others. It involves improving parameters such as kernels.

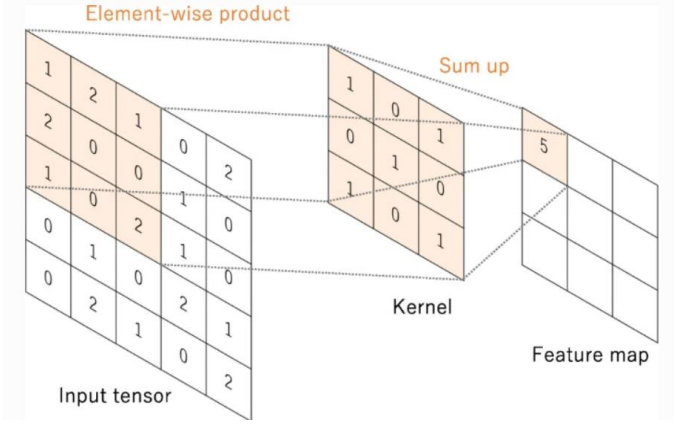


Figure 4: CNN kernel

Measure	InceptionV3	ResNet
Accuracy	*85.8*	*74.3*
Precision	*87.4*	*66.7*
Sensitivity	*85.1*	*49.7*
Performance	*Best*	*Fair*

Table 1: comparison between CNN classifier inceptionV3 and ResNet

4) ANALYSIS AND DISCUSSION

The proposed methodology has two parts, Part One Skin Cancer type detection. Using Convolutional Neural Network with dataset ISIC2018 and learning model inceptionV3 by following this accuracy rate achieved was 85.8%. Part Two Mobile Application developed with the proposed detection technique.

It was found that There is a study made by scholarly journals examining the condition of smartphone procedures for cancer, the goal of this study was for the public with a focus on interactive features.

The Study has found 123 mobile apps (Apple = 40; Google Play = 83). Applications' characteristics were collected. These included the mobile platform, cost, application inventor cooperation, date of last update, the purpose of the applications, content sources, and interactive features [4].

Results of the mentioned study that 50 of the applications concentrated on general information for cancer. Next, this was followed by apps for breast cancer and skin cancer. Only 10 of the applications have descriptions linked to sources for app content. Interactive features included the capability to cover symptoms, side effects, treatments, and habitual pain. Only 3 of the apps stated content had been estimated by health providers.[4] By avoid these drawbacks an interactive mobile application was our solution to concentrate on detecting the type of skin cancer with interactive features for helping patients with skin cancer in easy manner.

Using Inception V3 showed better accuracy compared to another deep learning classifier ResNet as shown in table 1, ResNet uses Batch Normalization, Processing is divided by scale in Inception before being merged and repeated. ResNet has a more straightforward, single-scale processing unit with connections for data pass-through. The Training process is completed in 50 epochs. Learning rate is determined as 0.001 when comparing result found that Inception V3 get better accuracy

5) CONCLUSION

The proposed feature is skin cancer detection: the first stage is the dataset, the one used in this approach ISIC Dataset, next step is pre-processing for images such as Normalization, Segmentation, Followed by feature extraction from enhanced images, then applying Convolutional Neural Network. Comparison between 2 CNN classification models (Inception V3, ResNet) and found better accuracy using Inception V3 with accuracy 85%. Also, This study contributes to a streamlined analysis of mobile apps for cancer available in the digital health business. The findings have implications for information quality and supportive resources for cancer care. More transparent information on content sources, organizational confederations, and the role of health practitioner oversight in website content are necessary. Recommendations for perfecting the quality of cancer operations are also offered. For the future of this work, the proposed 207 styles can be combined with other algorithms like ANN[3], as ANN has advantage of having fault tolerance, working with incomplete knowledge. Additionally as future work combine between Inception and ResNet, As from privilege of ResNet, It offers direct bypasses from lower layers to higher layers. This demonstrates the creative potential of neural network architectural design.

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