Skin Scan: An Android Based Mobile Application for Skin lesions Detection using Alex Net*

Ridone Bhuyian
Computer Science And Engineering
Green University of Bangladesh
Dhaka, Bangladesh
ridoneakash5@gmail.com

***Abstract*—Used by millions of people, mobile applications make it easier for humans to get up-to-date information. It's not uncommon for users to search for answers from the virtual world, even health problems. In this study, We build a complete Application to analyze and detect skin lesions through a Convolutional natural network known as Alex-net. Skin lesions are a very common matter in countries like Bangladesh, where every year a large number of people suffer from them. It's very challenging to identify skin lesions through human eyes; therefore it's important to build an functional system that can do that job well. Our lesions detection system takes an image of around 3000 consisting of 8 different lesions and uses it to train a deep neural network.**

We believe that the proposed model can be used for the detection of skin lesions in any area where there is a need for such an application. The model is highly accurate, which means we can build an Android application using it; as well as provide solutions based on detected lesions—like how we can help people who suffer from whatever kinds of skin lesions by providing solutions based on detected lesions.

***Index Terms*—Skin lesions Detection, Mobile Application, Image Analysis, Convolutional Neural Network.**

I. Introduction

We'll see how a simple automated system can help people easily diagnose skin conditions and act on them to avoid wasting their health and money. Android phones are now affordable and accessible to low income groups. This system can help people easily diagnose skin lesions and act appropriately to keep away from wasting their health and money. The objective of this project is to create an Android application capable of detecting skin lesions using images captured by a smartphone camera. This will empower consumers and allow them to have better preventive approaches for skin lesions . Research works in advance identification of skin lesions have been done and numerous experimenters have approached varied ways to identify skin lesions. Deep learning, Convolutional learning, and Neural Learning are some of the ways being used to attempt to answer the complication [2]. The underlying technology used in TensorFlow is Google's open source software library for machine learning. The tool is designed such that it can run on mobile devices with minimal hardware requirements. Skin Scan can be used for the detection of skin lesions from images captured with a mobile device's camera and provide users with a diagnosis results. The project aims to build a convenient Mobile application called "Skin Scan" which detects skin lesions from images captured by a mobile device, and provides information about possible treatments for the user. We will also create an extension that lets users take pictures of their own gallery , so that they can receive personalized analysis reports on their skin signs. As the condition progresses, changes occur on the skin; this includes variation in colour and size [4]. With deep convolutional neural networks. We can train the model and generate a model to identify skin lesions. With the app, users capture skin images with any medium-quality mobile camera. The photo is then processed and Then the integrated algorithm is compared to detect the lesions and provide online solutions based on the skin lesion. Hence, users can cultivate time and money in addition to their health through figuring out their troubles early.

II. Related Literature and Studies

There have been many studies showing that types of skin lesions can be detected using image processing-based techniques. Here we present a summary of these methods that have been discussed in more detail by other researchers.

[5] proposed a system for dissecting skin lesions using colour picture without the necessity for medical interfere. This Model consisted of several steps. First of all, we used colour image processing ways(k- mean clustering and colour grade ways) to descry infected skin and identify lesions tissue. Next, they classify the lesion types using ANN. These system has been tried on 6 different skin conditions and has an average delicacy of65.99 for Stage 1 and64.016 for Stage 2.

The system of [6] can be used to descry skin conditions. In this process, the further features uprooted from the image, the more accurate the system. The authors of[6] applied this system to 9 different skin conditions and achieved an delicacy of over to 70.

Carcinoma is a type of skin disease that's can be deadly if not diagnosed along with treated on its starting stages. The authors of [7] concentrated on studying different segmentation ways that can be applied to descry carcinoma by image processing. In order to prize further features, it's described as falling on the boundaries of infection points.

[8] developed a melanoma individual tool for tan skin by a technical algorithmic database containing images from colourful melanoma resources. also [5] described the bracket of skin conditions similar as melanoma, Nevus, seborrhea's keratosis(SK), basal cell melanoma(BCC), using the support-vector-system(SVM). SVM offers the stylish delicacy among various other ways. Chronic skin conditions, on the other hand, can have serious consequences in different parts of the world.

[9] therefore suggest a automated system to automatically descry nevus and determine one-s inflexibility.The system contain of three way(1) effective segmentation by skin discovery,(2) colour, texture, and edge point birth, and(3) graveness determination using a support-vector-machine(SVM). increase.

[10] proposed a different method to descry skin conditions. The system combines computer vision and machine literacy to descry skin changes caused by complaint and uses both ways to prize features from images and identify skin abnormalities.

III. Methodology

A. System Overview

Figure 1 shows the outline of the proposed system. App users capture images of the affected area using the phone's camera. Scanned images are processed using a pre-trained model built into SKIN SCAN for accuracy-based results regardless of whether the skin is healthy or lesions. Results display the specific lesions name and lesions information online.

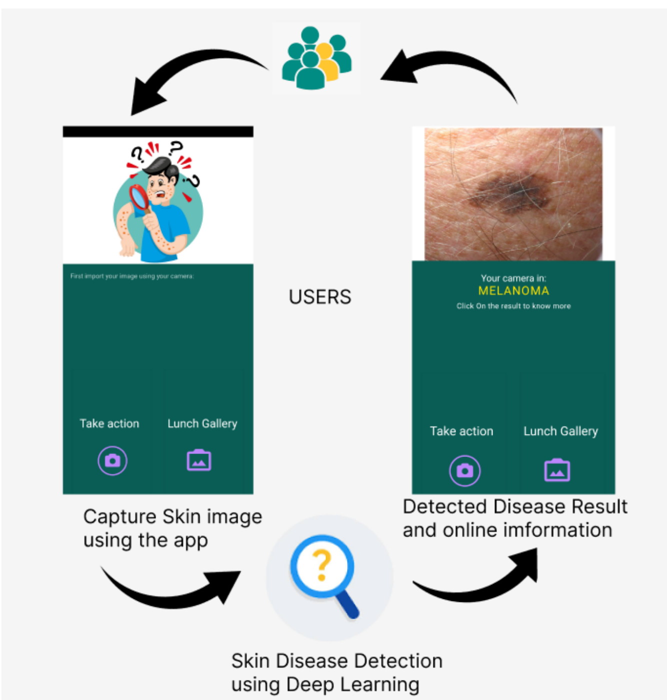

Fig. 1. System Overview

B. System Evolution Method.

The evolution of the system is described in Figure 2. It displayed the-specific path followed by the system from build a model to applying it in operation.

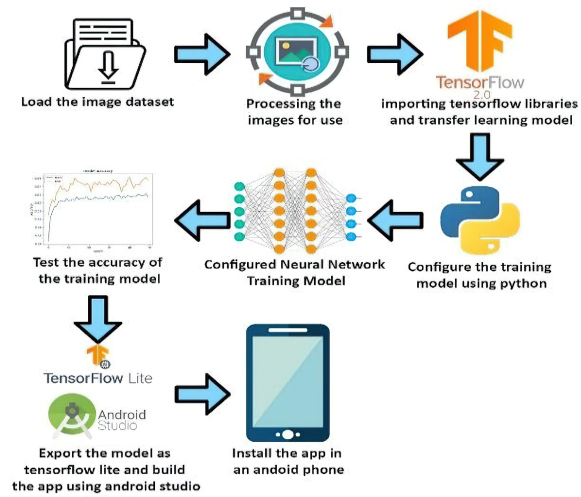

Fig. 2. System Development

The system development are expressed in a comprehensive way as following:

C. data-set Collection and Load.

This data-set was created by our collected image data and can be set up on "Kaggle". The images resolution are 224x224 pixels. The data-set of 3000 images of skin conditions is used for training a model. The model use train- validation split as 80% to 20%, which means 2400 pictures for trained the model and 600 pictures for validate the model.The images are stored in jpg format. The data-set contains images of 7 different conditions of the skin, as well as one class for healthy skin.Fig. 3 displayed few selections from the data-set, while Table (1) provides farther information about it.

Fig. 3. Sample image of the data-set

D. Image Preprocessing

The preprocessing () function applies contrast-limited adaptive histogram equalization (CLAHE) to the training and test images. The preprocessing consists of three steps:1. Contrast-Limited Adaptive Histogram Equalization (CLAHE): It is an algorithm for local contrast enhancement, that uses histograms computed over different tile regions of the image [11]. The

TABLE I
DATA SET DESCRIPTION

Class	Total Image
Acne and Rosacea Photos	312
Bullous lesions Photos	313
Herpes HPV and other STDs Photos	302
Melanoma Skin Cancer Nevi and Moles	186
Nevus	300
Tinea Ringworm Candidiasis and other Fungal Infect	325
Vascular Tumors	321
Healthy Skin	322

main idea behind CLAHE (but also the ordinary histogram equalization) is that each pixel is transformed based on the histogram of a square surrounding the pixel by using a transformation function 2. Random Flip, Resealing, Resizing, Rotation, Median Filter: The median filter is a non-linear digital filtering technique, generally used to remove noise from a picture. It is also widely used in pre-processing steps to improve the results of later processing such as segmentation and feature extraction—indeed one of its main advantages is that it preserves edges while removing noise. A window or structuring element is applied to each pixel of the picture. The pixel under the origin of the structuring element is replaced with the median of its neighboring pixels.

E. Choosing and Configuring the Architecture Model

To train a model, you need an architecture model. Use Tensor Flow Hub to import your preferred architecture into your model. Tensor Flow is a software library developed by Google used for data flow and differentiable programming [12]. Our work focuses on the applicability of deep CNNs. In particular, this work focuses on one architecture: Alex Nets. Alex Nets are a family of neural network architectures for effective image classification on devices and related activities. Alex nets are available in different sizes controlled by the depth multiplier of the convolutional layer. Alex net can also be trained on input images of different sizes to control the speed of inference [13].

Convolutional neural networks consist of a number of stacked layers that process the data. The main components of a CNN model are linear repair nonlinear unit (ReLU) sub-casts connected to regular multi-layer neural networks called complication sub-casts, pooled sub-casts, fully connected sub-casts, and vice versa loss sub-casts. CNN are known for their excellent performance in operations similar to visual activity and natural language processing.

Alex-Net has five convolution layers; a nonlinear ReLU layer is piled after every convolution sub-caste. In addition, the first, second, and fifth layers contain max-pooling layers, also, two normalization position are piled after the first and the alternate complication layers. likewise, two completely connected layers at the top of the model are anteceded by a soft- maximum sub-caste. Alex- Net was trained using farther than1.2 million images belonging to 1000 classes.

F. Checking the Accuracy of the Model.

When a model is configured, the model is trained for several epochs to check accuracy. This process helps to ensure that the model achieves the highest possible accuracy. In addition to checking over-fitting and under-fitting, it is important to plot a graph of accuracy and loss of the model. This graph shows how well the training went, which will help us tweak our parameters in order to achieve maximal accuracy in future training runs.

G. Exporting the Model and Building the Skin Scan Application.

In this step, the trained model is exported to tflite model, and an android application is developed using Android Studio. The application is then ready to be installed in an android smartphone to use.

IV. RESULTS AND PERFORMANCE ANALYSIS

A. Comparison of the Model Architectures

In this work, we are interested in how the CNN model is trained multiple times with different parameters similar as batch size, learning rate and ages changed. The literacy rate determines the step size for each step in moving towards the minimal loss. An time refers to the total number of times the entire data-set has been trained by a deep literacy algorithm. After enough trials, the model showed the stylish results with a batch size of 16, a literacy rate of0.001, etc. The model has been trained over 300 ages.

The CNN model has been trained multiple times and has performed well. This can be seen in Table 2 where it shows that there is no significant difference between all models' performance on average over all epochs with respect to accuracy or F1 score (0.543).

TABLE II
DATA SET DESCRIPTION

Architecture	Alex-Net
Accuracy	83.1%
Precision	62.4%
Recall	60.9%
Model Size	90 MB

Presented metrics include: Accuracy. It's defined as TP TN/ TP TN FP FN and in our environment represents the number of images that are rightly classified among all the test images.

Precision. It's defined as TP/ TP FP and represents the capability of the classifier to avoid false cons.

Recall. It's defined as TP/ TP FN and represents the capability of the classifier to avoid false negatives.

F1-score. It's defined as precision + recall/ precision and can be interpreted as a weighted normal of precision and recall.

Model Size. The size of the trained model (MB) is a very important indicator of performance. In this experiment, the storage size of the complete trained model is used as an indicator of performance.

The architecture used in this experiment was Alex Net. It can be seen in Fig. 4. Alex Net performs better than other framework for the similar attributes. thus, Alex Net is chosen to make the ultimate model.

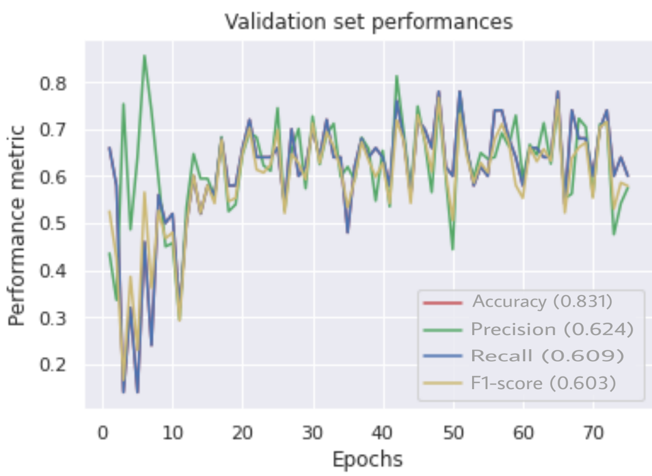

Fig. 4. Performance of the Alex-Net architecture.

B. Skin Scan Android Application's UI and attribute

The user interface and features of that system are shown in Figure 5. The system has two separate screens and three attributes. They are:

a) Introduction Page: Oping screen of the application. From this page user get details information about the diseases.

b) Home Page: The Second page of the application. When the user presses the "Scan" button, the application displays the main screen. There are two buttons for scanning skin. The leftmost button takes user to the image scanning page and the rightmost button takes user to the gallery.

c) Gallery: This button help the user to load previous capture image.

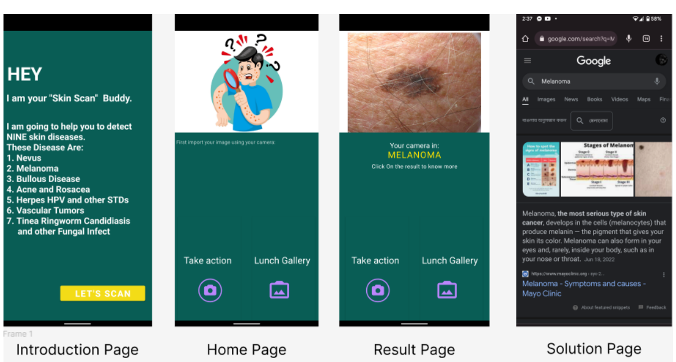

Fig. 5. Mobile Application and Feature

d) Scan Skin: This is the main module of the application. By Clicking the camera button, it takes the user to the image scanning page. After that, press the "check mark" button, detected skin lesions will be displayed.

The application is divided into three main modules: capture, scan, and diagnose. The first module captures an image from the camera; this module is also responsible for loading previously captured images from the gallery. The second module scans an image for lesions; it then displays those lesions in a list on top of a grid. Finally, this module diagnoses lesions based on their appearance in an image.

e) Solution: The user is able to see the lesions name and other information of the lesions in a single glance.

V. Conclusion and Future Work.

The model was trained using a large skin lesions image data-set and achieved an accuracy of approximately 91%. This demonstrates the admissibility of the system. The trained model captures an image of human skin as input, processes it, and uses CNN (Alex Net) algorithms to describe and identify the skin conditions. This application also provides the necessary procedures for complaint prevention and attention. The low prices of modern Android mobile devices have made Android devices affordable even for low-income workers. The application proposed in this study works well even on low-end devices. In this report, we propose a system for detecting skin lesions accurately and taking action accordingly. The proposed system is based on machine learning and can be used to accurately detect skin lesions and act accordingly. This system helps prevent health hazards. The data-set used in this study contains images captured in indoor lighting and environments. Therefore, we successfully tested the model on a real data-set and found that the proposed model performed about 10-20% worse. However, this limitation can be overcome by using image data sets acquired in real-world settings. The current app is interesting, but it could be explored further to add new features and make the app more usable. We also aim to build a system using data sets and images that are different from other lesions.

Acknowledgment

I would like to express my gratefulness to my supervisor, Mr. Anwarul Islam, who guided me throughout this project. I would also like to show my deep appreciation to Mr. Humayan Kabir Rana who offered valuable data and statistics which I used in my design.

References

[1] Bangladesh: Growing The Economy Through Advances in technology https://www.worldbank.org/en/results/2016/10/07/bangladesh-growing-economy-throughadvances-in-agriculture, last accessed 2020/10/09.

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] Patel, A., Joshi, M.: A Survey on the Skin lesions Detection Techniques. IJARCCE. vol. 6, pp. 229-231 (2017). doi: 10.17148/ijarcce.2017.6143

[4] Yunbin, D.: Deep Learning on Mobile Devices - A Review. SPIE Defense + Commercial Sensing (2019). doi: 10.13140/RG.2.2.15012.12167

[5] Thorat, N., Nikam, S.: Early lesions Detection and Monitoring Large-Field of lesions by Using IoT. (IJCSIS) International Journal of Computer Science and Information Security. vol. 15, pp. 236-248 (2017).

[6] D M, S., Akhilesh, Kumar, S., M G, R., C, P.: Image based skin lesions Detection in Pomegranate skin for Bacterial Blight. 2019 International Conference on Communication and Signal Processing (ICCSP). pp. 0645-0649. IEEE, Chennai, India (2019). doi: 10.1109/iccsp.2019.8698007

[7] Valdoria, J., Caballeo, A., Fernandez, B., Condino, J.: iDahon: An Android Based Terrestrial Skin lesions Detection Mobile Application Through Digital Image Processing Using Deep Learning Neural Network Algorithm. 4th International Conference on Information Technology (InCIT). pp. 94-98. IEEE, Bangkok, Thailand (2019).doi: 10.1109/incit.2019.8912053

[8] Ferentinos, K.: Deep learning models for skin lesions detection and diagnosis. Computers and Electronics in Agriculture. vol. 145, pp. 311-318 (2018).doi: 10.1016/j.compag.2018.01.009

[9] Mahalakshmi, J., Shanthakumari, G.: Automated skin Inspection and Pest Control Using Image Processing. International Journal of Engineering Research and Development. vol. 13, pp. 25-35 (2017).

[10] Thakre, G., More, A., Gajakosh, K., Yewale, M., Shamkuwar, D.: A Study on Real Time skin lesions Diagnosis System. International Journal of Advance Research, Ideas and Innovations in Technology. vol. 3, pp. 1118-1124 (2017).

[11] Raut, S., Fulsunge, A.: skin lesions Detection in Image Processing Using MATLAB. International Journal of Innovative Research in Science, Engineering and Technology. vol. 6, pp. 10373-10381 (2017). doi:10.15680/IJIRSET.2017.0606034

[12] Contrast-Limited Adaptive Histogram Equalization (CLAHE). Wikipedia. Available online:https://en.wikipedia.org/wiki/Adaptive_histogram_equalization

[13] Histogram Equalization. Wikipedia. Available online: https://en.wikipedia.org/wiki/Histogram_equalization

[14] Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning. http://www.deeplearningbook.org. MIT Press, 2016.