Artificial Intelligence for Improved Dermatological Diagnostics (DermaAITM)

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***Abstract*—**Nowadays people across worldwide are facing different types of skin diseases. Skin diseases can be caused by several factors like allergies, infections, when body is exposed to harmful UV rays etc. It makes our skin itchy, red and dry. Poor hygiene may also contribute. People need to be aware of these skin diseases to cure with proper medications. By considering these obstacles of precise and prompt skin diseases we introduced DermaAITM which utilizes machine learning algorithms to analyze dermatological images and provide tailored medication for their treatment. Providing medicines for skin disease through a system has many benefits. It helps people to get treatment quickly. The system is cost-effective and takes less time. People can access healthcare services from their homes particularly beneficial for individuals living in rural areas. DermaAITM uses Yolov8 to train the model. We used open dataset available in Roboflow which contains 12 classes of skin diseases. By leveraging machine learning and AI technologies our system predicts the type of disease, based on the identified disease system recommend medications.

Keywords—Skin disease detection, Yolov8, Machine Learning, OpenCV(Computer Vision)

I. INTRODUCTION

Present days most of the people are facing several skin diseases which are caused by various factors. Dust allergies, rashes, infections, UV rays these are the several reasons which causes skin diseases. Intake some food items may also cause skin infections for some people. Skin diseases ranging from common types like acne and eczema to severe types like psoriasis and melanoma. These diseases occur by several factors like genetical disorder, infections, life style choices. For example, an acne may experience by people of all ages due to harmonal imbalance, excess oil(sebum) production, bacterial infection, inflammations, heredity etc. are the reasons. Eczema might develop as a result of allergens such as cold and dry weather, dampness things such as dust mites, animals etc. in the environment. Common triggers of eczema include detergents and soaps, shampoo etc.

Doctors may or may not be available to everyone at particular time. People tend to get nervous whenever a slight change happens in their life. An unexpected disease and improper treatment can change one's life upside down. Our system can diagnose the disease and can also prescribe the medications, Monitoring patient condition can be seen by only by doctors and prescribe medicines for their situation. Although doctors may not be available and also get tired by their schedule patient's condition may become serious. Some of the common skin diseases occurs are shown in Fig. 1.

Fig. 1: Sample images of skin diseases

Diagnosing these skin conditions is a difficult task between human expertise by visual assessment. Sometimes it is more difficult for rural people to consult the doctor for treatment. This can be expensive to get a doctor every time for treatment for rural people and also time taken. For small change in skin condition may lead to severe damage sometimes. Most of the people have no time to consult a doctor in their daily life because of their busy schedules and work so they take it as granted. It may lead to serious problem in future. Detecting the type of disease along with recommending proper medications may also helpful. It makes easier for people to get treatment quickly, especially for people who can't reach the doctor.

By considering all the factors we introduced a system called DermaAITM. There are already some systems which can identify type of disease but they are confined to one class of disease or two to three classes. There is no system exist which recommend medications. DermaAITM is a team effort between human and machine our intention is to make sure everyone should get good healthcare. This system is designed to make things simpler for people who have skin issues, so they no need to consult doctor for every little thing.

This system uses machine learning model called Yolov8 (You Only Look Once) is state of art object detection model which is known for their accuracy and speed is used to train the model to detect the classes in images in real-time. The dataset we used to train the model is publicly available dataset available in roboflow. The dataset contains 12 classes of skin diseases includes Acne, Chickenpox, Eczema, Monkeypox, Pimple, Psoriasis, Ringworm, Basal cell carcinoma, Melanoma, Tinea-versicolor, Vitiligo, Warts. Some of these diseases are common types like acne, eczema, pimple, ringworm, tinea versicolor, vitiligo and warts and some of them are severe types like psoriasis, melanoma, monkeypox and basal cell carcinoma. Around 3500 images are included in the dataset of 12 different classes for train, test and validate. OpenCV it is a computer vision library is used to perform various manipulation tasks as resizing the images, to draw boundary boxes and class labels on the detected images for efficient detection and visualization. It is a challenging application for doctors to treat skin diseases and it is useful for each and every individual.

II. LITERATURE REVIEW

[1] Tanzina Afroz Rimi in the year 2020 published a paper" Derm-NN: Skin Diseases Detection Using Convolutional Neural Network" used Convolutional Neural Networks in order to classify the images. The classification of the diseases by giving the images(pixels) as input is done by using Convolutional Neural Networks. Deep Learning techniques are used for skin diseases diagnosis. Clinicians' procedure is divided in to 2 sections. one is introductory screening and the other is dermoscopic imaging. And both are classified by using CNN. Dataset collection is based on preparing and testing stages.

[2] HONG QING YU AND STEPHAN REIFF-MARGANIEC in the year 2021 proposed Artificial Neural Networks (ANN), Decision tree, Logistic regression, and Support Vector Machines (SVMs) as well as an Unsupervised Machine learning method (KNN) are used for skin disease classification. ANN works better than SVM by around 10% accurate rate and

produces 85% accuracy on the given input images. Deep Learning models are used in order to see that they can produce more better results than SVM and ANN.

[3] The edition named" Discriminative Feature Learning for Skin Disease Classification Using Deep Convolutional Neural Network ", was published by the Research Grant from the Shenzhen Institute of Artificial Intelligence and Robotics for Society (AIRS) by BELAL AHMAD, MOHD USAMA, CHUEN-MIN HUANG in year 2020.The application was developed based on the techniques like CNN is used for learning discriminative features from skin disease images. The Fine-tuning is Applied to ResNet152 and InceptionResNet-V2 models to adapt. The Triplet Loss Function is used to bind the distance between the corresponding images. The Deep learning is employed to automatically extract features, train models, and fine-tune pre-trained networks for accurate skin disease diagnosis and the Image acquisition used to obtain the high-quality, labelled data from a reputable source. The application was developed for the purpose of identification and classification of skin disease for various cause. The datasets created from the different skin disease images. The classification is based on interpretation of features. The advantages of this project is its ability to accurately classify skin diseases, facilitating timely diagnosis and treatment. The disadvantage is it is potentially limiting its adaptability to new or diverse datasets. In the future we may see the adaptation of the new data sets and get the medical prescription for the identified disease.

[4] Mostafiz Ahammed, Md. Al Mamun in the year 2022 published a paper named “A machine learning approach for skin disease detection and classification using image segmentation”. This approach introduces a digital hair removal technique using Gaussian filtering. DT, SVM, and KNN classifiers efficiently classify skin images into eight categories. Validated on ISIC 2019 challenge and HAM10000 datasets obtained an accuracy of 95%.

[5] The editorial named "EczemaNet: A Deep CNN-based Eczema Diseases Classification" published by the Journal Of 2020 IEEE 4th International Conference on Image Processing, Applications and Systems (IPAS) was developed by the help of deep CNN-based approach to classify five classes of Eczema, addressing a gap in automated detection systems. Data augmentation techniques enhance model performance, while regularization methods like batch normalization and dropout reduce overfitting. Leveraging the power of CNNs, the approach achieves an accuracy of 96.2%, surpassing previous state-of-the-art methods and offering a promising advancement in Eczema diagnosis and the Index Terms used are Eczema diseases, classification, dataset; artificial intelligence, CNN, computer vision. The dataset provides diverse examples of Eczema manifestations, facilitating robust training and enabling accurate classification by the deep CNN-based model. The classification task entails accurately categorizing various types of Eczema using the trained deep CNN-based model. By the research, it emphasizes the merits of providing complete detail of the disease and the type however, it has the challenges of providing prescription for the disease. The Future scope of editorial includes merging advanced technologies and making modifications based on identifying the disease more accurately.

[6] The article titled "Skin Lesion Analyser: An Efficient Seven-Way Multi Class Skin Cancer Classification Using MobileNet" which was published in 2020 by The Department of Computer Science & Engineering, Priyadarshini Institute of Engineering & Technology, Nagpur-440019, India. The application was developed by the aid of transfer learning with a pretrained MobileNet model on ImageNet, fine-tuned on dermoscopic images, enhancing skin cancer classification accuracy to assist dermatologists in critical decision-making stages. They are used for the detection of the disease easily. The keywords used are Skin Cancer, Dermoscopy, Classification, Convolutional Neural Network. The dataset engaged on detecting the various skin diseases. The classification tasks are performed by Transfer learning. The merits of research include the increase in the accuracy rate than the previous ones. It have the limitations that it does not show that in which stage the disease in present and how much serious

it is. In the future we may see the modifications of increasing in the accuracy and stage detection.

[7] The research paper labelled "Skin Disease Detection Using Image Processing and Neural Networks ", was published by The International Journal of Progressive Research in Science and Engineering Volume-1, Issue-4, July-2020. The application is developed based on techniques such as machine learning and image processing technologies to diagnose skin diseases via smartphone cameras, offering an affordable solution in regions with limited access to dermatological services. Image processing filters remove noise and unwanted elements, ensuring uniformity for accurate analysis, while machine learning algorithms process image data to generate diagnosis results, enhancing accessibility to dermatological care. The dataset is on diverse images of skin diseases. The virtues of research involves that it is easier and affordable for everyone to detect the skin disease type. It has the limitations that it is limited to some skin disease type. In the future we may see the modifications of increasing in the accuracy of detection and medication description.

[8] The research paper named" Skin Disease Recognition: A Machine Vision Based Approach ", was published in the year 2021 by the International Conference on Advanced Computing & Communication Systems (ICACCS). The application is developed based on techniques such as image processing techniques, particularly colour segmentation, combined with SVM classification, enabling rapid and low-cost recognition of various skin diseases. By extracting relevant features from images, the system achieves a high accuracy rate of 94.79% in identifying eight different skin conditions, offering simplicity and versatility across programmable devices like desktops, Android phones, and iOS devices. The dataset is on diverse images of skin diseases. The classification tasks are performed by features. The virtues of research involves that it is easier and affordable for everyone to detect the skin disease type. It have the limitations that it is limited to the some skin disease type .In the future we may see the modifications of increasing in the accuracy of detection and medication description .

[9] LING-FANG LI, XU WANG, WEI-JIAN HU, NEAL N. XIONG YONG-XING DU in the year 2020 published a paper “Deep Learning in Skin Disease Image Recognition: A Review”. A lot of attention is seen in market regarding deep learning, especially diagnosing conditions. Irrespective of background and ages skin diseases often cause the problem, such is why early detection is important and crucial for better treatment. Our skin plays a key role in supporting body functionalities by protecting from harmful UV rays and environmental damages, which leads to diseases.

In this case study, the researchers review on 45 different efforts since 2016 just focusing on detecting skin diseases using deep learning. They analysed different kinds diseases types, datasets, model performance and data processing methods. The main challenge while analysing the disease constraints is similarity. Deep learning has a special place in identifying the similar images and provide specific and accurate analysing. This study is not only a reference for dermatologists but also helps in image recognition in effective way.

[10] In the year 2023, Junpeng Zhang, Fan Zhong, Kaiqiao He proposed a paper "Recent Advancements and Perspectives in the Diagnosis of Skin Diseases Using Machine Learning and Deep Learning: A Review". In this paper, integration of machine learning and deep learning has advanced diagnostic accuracy, precision and way more treatment efficiency. This paper particularly presents a better review of research focusing machine learning and deep learning. To study further and deeper, articles from prominent databases like IEEE, Springer, Web of Science, and PubMed, where they have focused from last five years. Skin, is known as body's largest organ helps in shielding and covering from harmful ultra-violet rays and also from harmful gases from environment. This paper not only talks about researchist analysis but also provides base for many researches.

[11] The authors named Ahmed A. Elngar , Rishabh Kumar , Amber Hayat , Prathamesh Churi published a paper in the year 2021 named “Intelligent System for Skin Disease Prediction using Machine Learning". It's always a challenging issue in healthcare due to the complex nature and lack of sufficient medical infrastructure. While showing the problem to the world, many cases go unnoticed. This paper proposes a system by introducing a system called CNN-SVM-MAA, which has the combinations technologies like Convolutional Neural Network (CNN) with Support Vector Machine (SVM) to get a Mobile Android Application (MAA) for better skin diagnosis. The system is trained with 3000 collected images from different kinds of sources, including websites an hospital. If we consider the example, In the USA approximately for every five individuals one person suffers from skin diseases, these diseases can be caused by different aspects including genetics, environmental conditions and regions. For every disease it is always important to identify and the disease because every upcoming stage can be harmful and might get severe.

III. PROPOSED WORK

Our method aims to detect several types of skin diseases from an image and recommend appropriate medications to get instant treatment to the disease. The procedure is divided into 3 different stages. The first stage is to collect the real-time data. The second stage is preprocessing the image and send those values to the trained model. The third stage is making predictions. Finally, the system can identify the disease name and provide medications along with instructions of how to use it in two ways. First one is by uploading the image of the skin disease affected area and the second one is live camera where user can get the disease name by placing infected area of body infront of the camera.

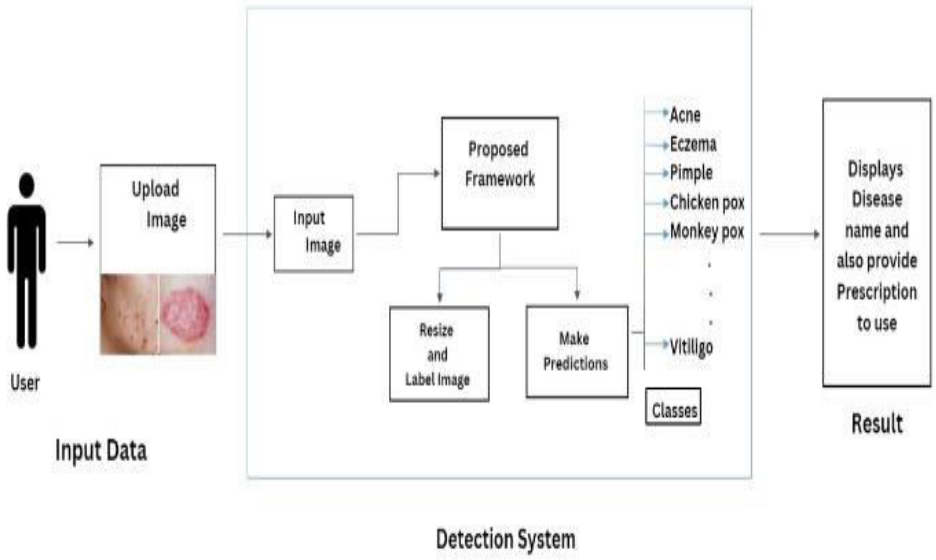

Fig. 2: Proposed architecture of skin disease detection

As shown in Fig. 2, to detect the disease we collected a dataset which contains classes of some common type of skin diseases and also some severe type of skin diseases from roboflow , a trusted platform for real-time data. The dataset includes 3500 real-time images including training, testing and validation subsets. The dataset includes 12 different classes of skin diseases named as Acne, Chickenpox, Eczema, Monkeypox, Pimple, Psoriasis, Ringworm, Basal cell carcinoma, Melanoma, Tinea-versicolor, Vitiligo, Warts. User can upload the picture of skin infected area in our website. Our system preprocesses the data from the image and then identifies the skin disease. On clicking medicines, it recommends the medication along with instruction

Preprocessing: It is a important step in data preparation to convert the data into suitable format for better results. In preprocessing the image under goes several manipulation tasks to get into a format. The image is resized to 640x640 frame which is suitable to label the data to make predictions. Auto-orientation is also applied. Augmentation techniques such as flipping, rotating is also applied to increase the diversity of training dataset to ensure accuracy and robustness. These pre-processed image values are converted into float values then send to trained model.
Training the model: Yolov8(You Only Look Once) is used to train the model which is a popular object detection model. The training process leverages the provided dataset which contains annotated and augmented images for training the Yolo model to detect the skin diseases. This model undergoes multiple epochs of training to detect and localize skin diseases in images. Throughout the training process the model parameters are adjusted to minimize the detection error to accurately identify the skin disease.

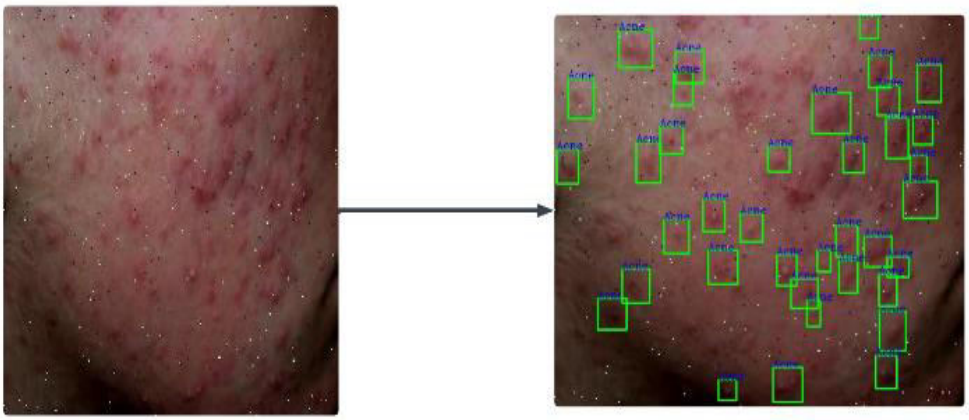

Fig. 3: Identification of skin disease

As shown in Fig. 3, predictions are made using OpenCV to detect skin disease in images. By evaluating the trained model with pre-processed values, it results in detecting of skin disease by making boundary boxes and class labels for detected disease in the image. A dictionary mapping skin diseases to medications is used to recommend appropriate medications as a result. It identifies the disease name and with the class labels when user click on detect disease the detected disease name will be displayed and when click on medicines it recommends the appropriate medications. Our system has another option to detect disease using live camera where user can place the infected area in front of camera it automatically identifies the disease name and then displays the name of the disease.

IV. RESULTS

We tested our system using various datasets which contains lot of different images in each class. Our system achieved great accuracy to identify the skin diseases of 12 different classes which includes some common type of skin diseases and some severe type of skin diseases which are most commonly occurred in all people. The following Fig. 4 shows the confusion matrix was evaluated on twelve different classes. The columns and rows indicate predicted labels and True labels, respectively. As we have twelve classes, the size of our confusion matrix is 12 x 12.

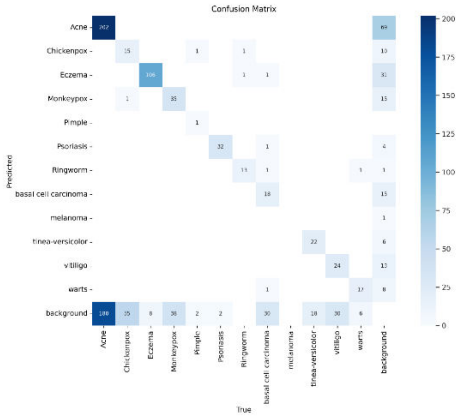

Fig. 4 Confusion matrix of our proposed DermaAITM

User can signup into our system using username, email id and password. After registering into our system a link is send to user registered mail id for authentication of user. It is valid only for several minutes then the link will be expired. Then the user again need to register. After successful verification user can login to our system using their username and password.

Fig . 5 User interface where user can upload image

According to Fig. 5, An interface will be displayed containing buttons like upload image, detect disease, medicines, live detect, reset and logout. When user click on upload image it navigates into their local storage from which user can upload the picture of infected area. A flash message is displayed when the image is uploaded correctly like file uploaded successfully.

Fig. 6 Identifying the disease name from image

As shown in Fig. 6, when user click detect disease button our preprocess the image by converting the image into suitable format by applying augmentations to predict the disease accurately the predicted disease name is displayed to the user . If the image is not clear when

the system can't identify the disease name from the picture it asks for re-upload of image with clarity. Then the system can identify disease name.

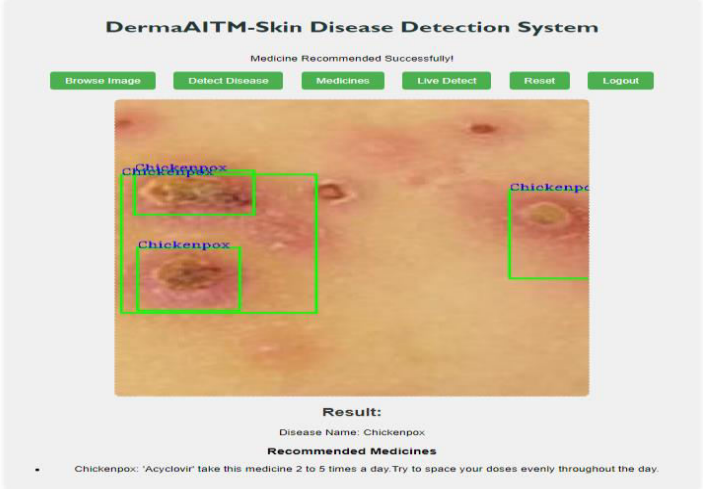

Fig 7 Recommending medications along with instructions

As shown in Fig.7 , our system recommend the medications to cure the disease quickly along with the instructions of how to use the medicine like how many times we need to take per day and when to take the medicine. When clicking on reset button user can newly upload the picture and when clicking on logout user can logout from their account.

V. CONCLUSION AND FUTURE WORK

Primary identification of skin diseases is very much important to prevent and cure. This methodology is very useful to classify the skin disease and suggest appropriate medications also more beneficial to get a instant solution to cure the disease. This approach not only provide the information about their condition it also provides the personalized medicines is an added advantage. Yolov8 is object detection model which gives high accuracy of disease detection. By including this innovative approach to skin disease detection system and treatment we can helpful to the advancement of telemedicine and providing healthcare services in rural communities where the availability of doctors is limited. Our system findings suggest that our system benefits for all people who try to get treatment quickly without the need of doctor. In future we try to expand the system of classify a greater number of diseases. By integrating with wearable devices which are equipped with skin sensors enables continuous monitoring of skin condition for early detection of abnormalities in our body. Also make available of online treatment from dermatologist to by booking appointment and get the treatment without physical interaction.

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