Real-time Skin Disease Prediction System using Deep Learning Approach

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***Abstract*—Skin illness affects a large percentage of the world's population. The proposed study proposed a deep learning-based model for skin disease predication, In the traditional system it was time taking to predict the result and the accuracy is not accurate, Different machine learning methods can be used to classify skin disorders. In this study, we used machine learning algorithms to categories skin disease classes using ensemble approaches, and then used a feature selection method to compare the findings produced. Specialist can detect the disease type with the help of a web-based framework which is developed in Python Django frame- work. In the proposed study, we present a novel approach to detect the skin disease. Here we have used Support Vector Machine (SVM) Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) classifiers to identify the disease. Specialist need to upload the image and Deep learning algorithms will predict the disease and display the accuracy. The proposed model is easy to use, but it also provides a higher level of accuracy than previous methods. As a result of this model, we were able to achieve a 95% accuracy rate in the diagnosis of various skin conditions. The proposed system provides a state of art accuracy for early skin disease detection**

Keywords-skin disease, machine learning, deep learning, disease prediction, support vector machine (SVM).

I. INTRODUCTION

Nearly all age groups are susceptible to developing skin diseases. The incidence of skin diseases has increased due to changes in lifestyle and environment. [1][2]. Indians suffer from skin diseases at a rate of 455.06 per 100,000, making them the 10th most affected country in the world, according to a study conducted in 2017[3]. It is estimated that one in five people in the United States has some form of dermatitis [4]. In most cases, these disorders are brought on by a variety of internal and external factors, including the cellular hierarchy, hormones, and the immune system. Skin disease may be caused by a combination of these factors or by a succession of them. There are both chronic and malignant disorders, such as eczema and psoriasis, which are both difficult to treat and difficult to cure. These disorders can be cured if they are diagnosed early enough, according to recent studies [5][6]. Establishing a web-based expert application for skin illness diagnosis that makes use of Deep Learning techniques like ANN, CNN, and SVM was deemed essential so that anyone who wants to or needs to learn about skin diseases might do so [7]. Skin diseases are very bad for a person's life and health. People sometimes try to fix their skin problems with remedies they have at home. If these treatments aren't right for that kind of skin disease, they could make things worse. Skin diseases are easily spread from one person to another, so they must be stopped as soon as possible. Most of the time, a doctor's conclusions about a patient's symptoms are based on his or her own experiences and personal opinions. If the decision is wrong or takes too long, it could hurt the health of people. Because of this, it is important and necessary to come up with effective ways to find and diagnose the signs of skin diseases early on. Many research articles and a lot of work from many different researchers got us to where we are now and gave us the direction, we needed for the model we built. Based on our research, we couldn't find a web-based framework that makes it easy for experts to figure out the type of skin disease in a short amount of time and with high accuracy. Without the help of these other researchers, I would not have been able to make any apps [8][9].

Using a web-based framework for skin disease identification, this research provides a comprehensive overview of existing machine learning techniques such as SVM, CNN, and ANN. The analysis is based on a dataset of skin diseases. According to the literature review, the best algorithms for detecting skin diseases are SVM, ANN and CNN. Python Django was used to create the web-based framework and method used in its creation. The ratio of input diseases to detected diseases is calculated for each skin disease type in the results section.. Our results shows that we have achieved more than 95% of accuracy to detect the persist disease at early stage. CNN architectures were trained and tested on seven classifications of skin lesions using the HAM10000 dataset [10] To solve the imbalance issue and the striking similarity between images of certain skin lesions, they used data augmentation (during training), transfer learning, and fine-tuning. DenseNet169 beat the other 11 CNN architectural variations, earning accuracy 92.25%, recall 93.59%, and F1-score 93.27%.

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A. *Structure of the Paper*

The paper is divided in the following section 2- Literature Review, 3 Methodology, 4 Existing System 5 Proposed System, 6 Software Design 7 Result, 8 Real Time Application, 9 Conclusion.

II. Literature Review

For the detection of skin disorders, numerous researchers have developed image processing-based methods. In this section, we quickly discuss some of the methods that have been documented in the literature. Color photos can be used to dissect skin problems without requiring a doctor's intervention. An artificial neural network is used to classify the type of disease after the infected skin has been detected using colour im- age processing techniques like k-means clustering and colour gradient identification. Tests on six different types of skin illnesses showed an average accuracy of 95% in the first stage and 94.016% in the second [11]. Detection of skin diseases begins with the extraction of picture features. The more features that can be retrieved from a picture using this method, the more accurate the system becomes. With a 90 percent accuracy rate, the approach was tested on nine different skin conditions by [12]. It is possible to die from melanoma if it is not diagnosed and treated early enough. For the purposes of early melanoma detection, the author of [13] investigated various segmentation algorithms. An example of a segmentation procedure is given that falls on the limits of the diseased area to extract more features.

To better diagnose Melanoma in people with dark skin [14], advocated integrating algorithms and photos from several Melanoma resources to build an app for dark skinned individuals. As an example, [15] used sup- port vector machines to classify skin illnesses such melanoma, basal cell carcinoma, nevus, and seborrheic keratosis (SK) (SVM). It's the most accurate method out of a variety of others. The research suggests that computer vision and ML can be used to create a model for identifying dermatological diseases from images. The elements of an image are utilized in conjunction with a set of algorithms to reliably identify six different diseases [16]. Clustering images based on navi categorization is offered by an "intelligent" for monitoring skin illness. They employed the SIFT approach to find the image's most important focal points. For classification and segmentation, they employed CNN and SVM. They have an 84 percent ac- curacy rate and an 82 percent precision rate [17].

A research paper called "Detecting Skin Disease by Accurate Skin Segmentation Using Different Color Spaces" has shown how different skin segmentation techniques are helping to find skin diseases. Also talked about were the different steps that are taken to find these diseases [18]. The Naive Bayes algorithm is used as a classification technique for skin disease identification and segmentation, while graphic cut methods are used for image processing of skin pictures [19]. New methods to identify skin illnesses using computer vision and machine learning have been proposed. Computer vision is responsible for extracting image features, whereas machine learning is in charge of spot- ting signs of skin illness. With a 94 percent success rate, the device was tested on six different skin conditions [20]. A model for recognizing skin diseases is proposed in a study titled "Skin Illness recognition approach based on picture color and Texture features." The model relies on the extraction of image features utilizing color texture, segmentation, and support vector machine classification. [21][22].

In order to extract features from images and forward feeds to an arti- facial neural network for training and testing, the study "Dermatological Disease identification using image processing and artificial neural net- work" has used a variety of various image processing techniques. The system comprises two stages; the first stage involves feature extraction based on color and texture, and the second stage involves a classifier that identifies potential diseases [23]. Proposed Neural Network classification was used to separate these characteristics using a 2D wavelet transform approach (BPNN). They designate whether the data set pertains to cancer or not [24]. using the naive Bayesian method to forecast various skin disorders. Automatic dermato- logical features of circulatory disease are derived from affected skin pho- tos using the Local Binary Pattern and used for categorization [25] [26]. The requisite image processing techniques, such as morphological procedures for skin detection, are also used to classify skin diseases [27] [28]. Automated eczema identification utilizing image processing and a support vector machine combines image segmentation, feature selection using texture-based information for more accurate predictions, and Support Vector Machine (SVM) evaluation of eczema progress [28] [29]. Introduced a novel approach to preprocessing the ISIC 2018 photos termed ESRGAN, and then used Resnet50, InceptionV3, and Inception Resent deep learning models to categories the images. Using the Convolutional Neural Network (CNN), Resnet-50 (83.7% accuracy), Inception-V3 (85.8% accuracy), and Inception-Resnet-84% accuracy models, they reached 83.2% accuracy [29].

III. Methodology

The following is the proposed approach to the study:
List of literature survey papers that are relevant to the skin disease problem that is to be worked on are included in the definition of the problem. Fig. 1 Show the flow of proposed work. Authors searched for 18 papers on the topic of skin disease prediction in the databases Scopus and Web of Science. Seven studies were excluded from our review because we didn't think they were representative of the overall quality of the research. We conducted a literature review and found that SVM is the most commonly used machine learning algorithm for categorizing skin disorders. Authors have found that in most of the paper only single algorithm has been applied. SVM, ANN and CNN are chosen as a classification and prediction technique to get better result and to show comparison of algorithm accuracy. The SVM, ANN and CNN are used on a set of data about skin diseases, and the results are shown. The right conclusion is reached.

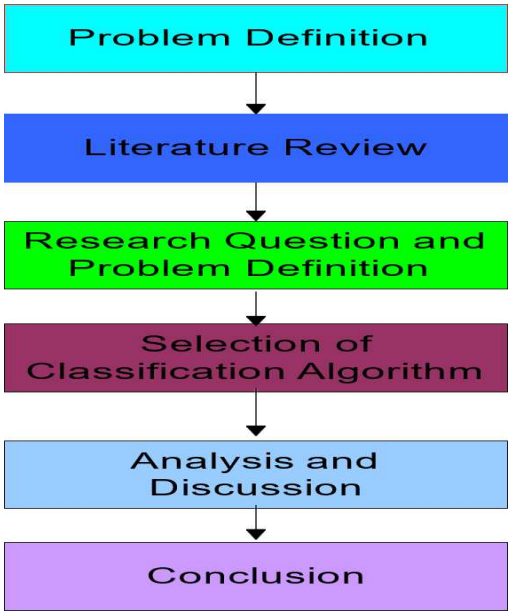

Fig. 1 Flow of proposed research work

A. Description of the Disease Dataset:

To be more precise and realistic, our dataset consists of over 3000 photos gathered from several websites devoted to skin diseases and their treatment. Training set and test sets have been created from the data. Our model is trained using data from the training set, and its accuracy is evaluated using data from the test set. Then, our dataset is segmented according to the diseases that need to be taught for each subset. Only pandemic diseases that have affected the entire planet are represented here. On the other hand, in subsequent updates we will incorporate an increasing number of additional disease-specific remedies.. The description of the disease dataset is provided in Table I.

TABLE I. SKIN DISEASE DATASET

Name of Disease	Disease Images	Total No. of Images
Eczema		210
Melanoma		119
Psoriasis		250
Onychosis		135
Hives		97
Cold Sores		267

Fig. 2 depicts the workflow of three categorization algorithms. Skin Disease Dataset provided the input skin image. It is referred to as the image capture phase in the Django web framework.

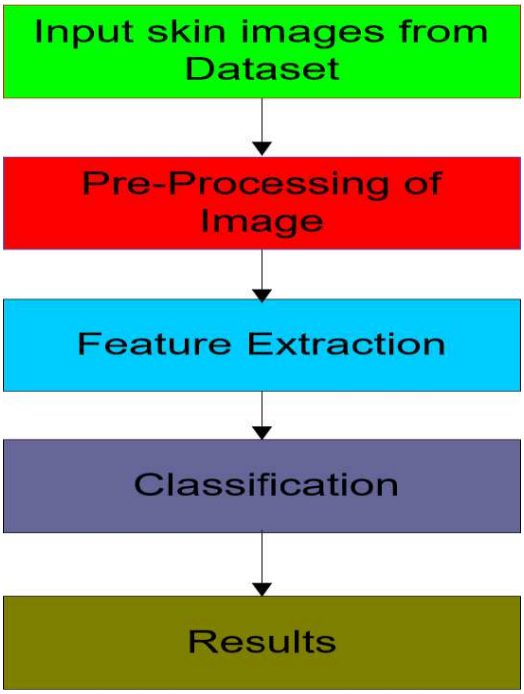

Fig. 2 Workflow of classification algorithms

It extracts a picture from a SQL Lite database. Pre-processing includes adjusting the brightness and contrast, as well as scaling the image in precise directions. For image feature extraction, we must employ an algorithm that works on different layers of the image to extract the image's features. This need necessitates the use of the CNN, ANN and SVM algorithms. The outcomes are shown on the web browser.

IV. EXISTING SYSTEM

The current system is heavily reliant on doctors and this is a time-consuming process. Many people do not receive proper skin care treatment. Some skin problems appear to be minor, yet they might cause major harm in the future. Skin expert specialists are not available in rural clinics. Furthermore, treatment is very expensive for the poor. Skin disease is not often recognized as predicted by professionals [27]. Current framework issues are as follows. A feed forward back propagation artificial neural network is employed in most existing systems with non-uniformly distributed nonlinear data. The Hidden layer (the network's middle layer) learns the data transformation necessary to make the data linearly separable, and then applies that transformation to the input data. This strategy yields somewhat less precise results.

V. PROPOSED SYSTEM

Fig. 3 shows the working of the Web based framework using Python Django which will work as follows

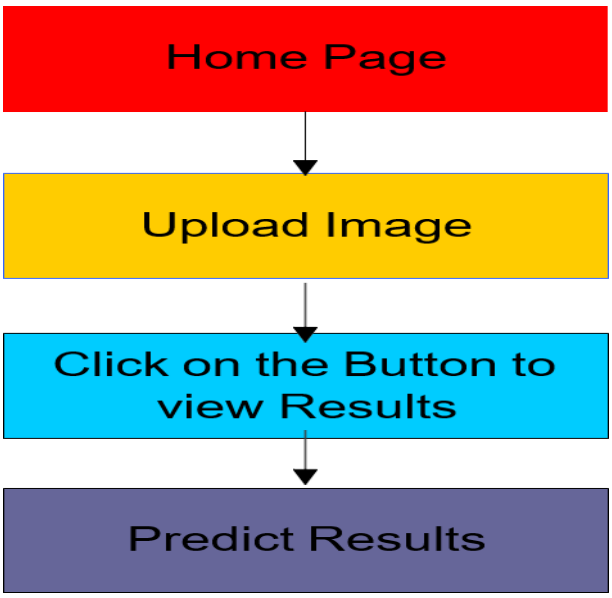

Fig. 3 Work flow of proposed system.

The initial step is to gather all of the input photos. Once the image is entered, it is pre-processed and compared to the datasets that have already been used for training and testing. The image's features are extracted after pre-processing. The condition is then classed as one of five diseases: hives, cold scores, melanoma, psoriasis, or eczema. This is a block schematic of the entire procedure.

VI. SOFTWARE DESIGN

In fig. 4 we have discussed the entire work flow of the system. Authors have work upon the skin disease dataset. Further the images are divided and algorithm applied. Authors enhance the algorithm to achieve high accuracy. A web-based framework is design to upload the images and predict the disease.

A. Django Web Application Work Process

The Django application is user friendly. To access protected areas of the site, User must first log in on the home page. The SQLite database handles authentication and data storage for the login screen and user profiles. Different options to transfer images from a database to a server so that they can be processed are displayed on the dashboard. Three algorithms (ANN, SVM, and CNN) have been used in our analysis. CNN has the highest accuracy of the three algorithms.

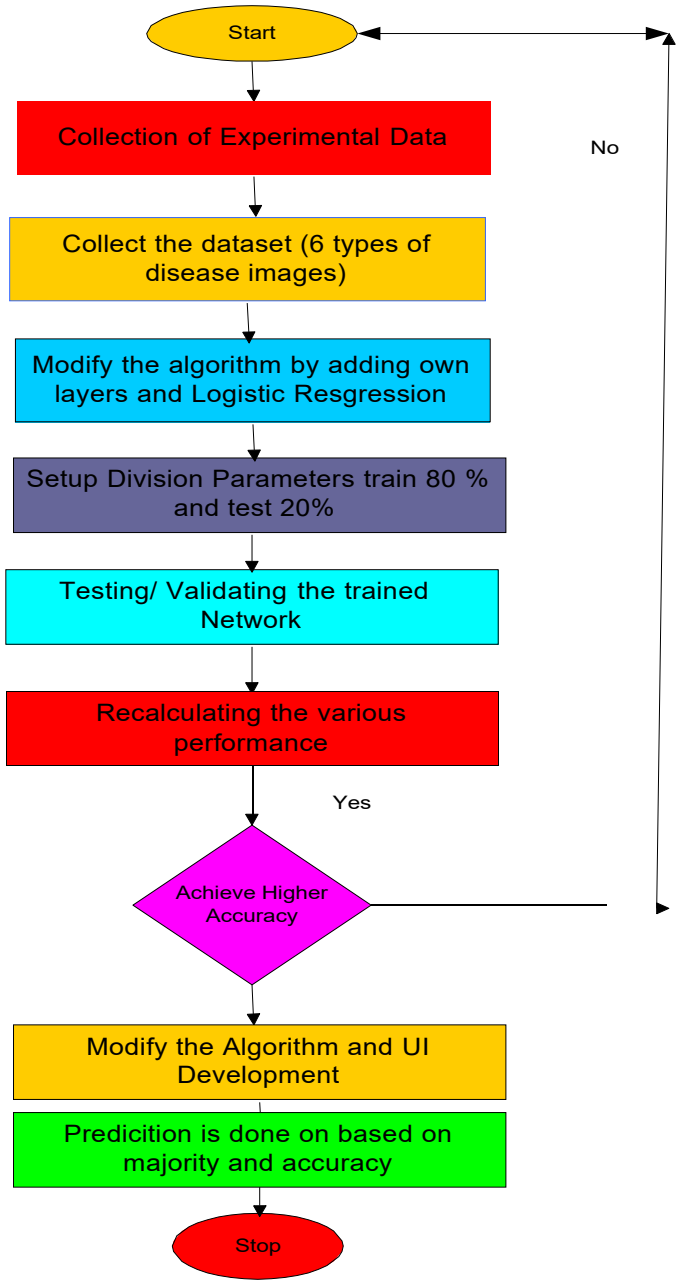

Fig. 4 Work flow

B. Login Form:

User can login with the credentials provided to access the web application. Fig. 5 shows the login screen of the proposed work.

Fig. 5 Login Form: To upload the image by user, need to browse the image from local machine and upload using upload button for further processing at server side.

Fig. 6 shows the upload image.

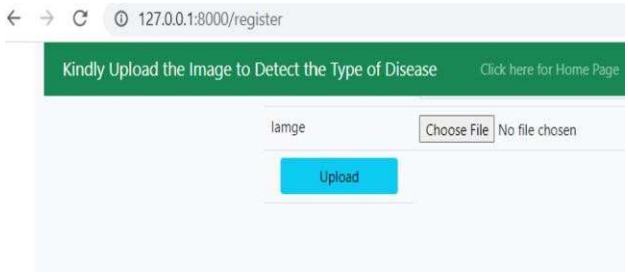

Fig. 6. Upload image.

VII. Results

There are three techniques which we have used to detect the type of skin disease. The developed system will use the classification algorithm to detect and predict the disease and will show the identified disease with a bar chart of algorithm used with their respective accuracy. Fig 7 shows the results of the proposed work. The system show that CNN provides the highest accuracy. The system can be used to predict the skin disease in real world environment,

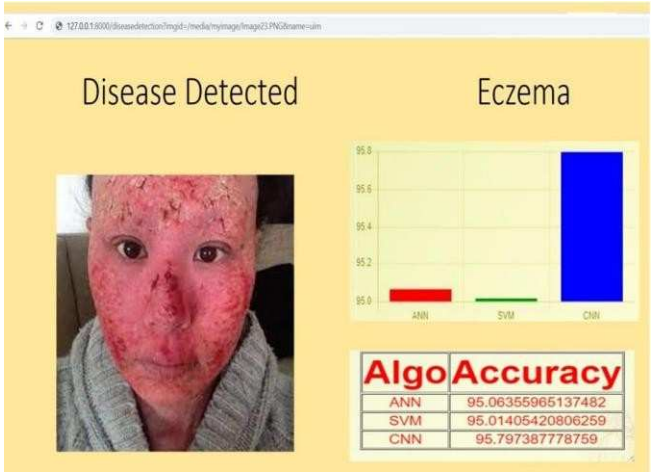

Fig. 7. Result prediction

VIII. Real Time Application

Every citizen who utilizes this web platform has access to acute disease predictions, and disease analysis can be done at home, eliminating the need for people to visit hospitals, nursing homes, or health facilities. This makes it easier to find the cause of a disease. It's easy to see what will happen. So, it can be used in small health care facilities in rural areas.

IX. Conclusion

Globally prevalent skin conditions have an impact on both patient health and the price of government-funded healthcare services. This article suggests a computer-aided diagnosis system in light of the benefits of skin disease diagnosis. The suggested approach makes use of thermoscopic pictures with deep learning and machine learning methods. The proposed system showed good outcomes, according to the results. The model predicts the skin disease at earlier stage and protect the person from the severe side-effect of the skin disease. The developed system work upon secondary and also primary dataset. The web-based system gives high accuracy,

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