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An AI Enable Dermatologist with Improved Accuracy using Machine Learning Algorithm

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Abstract
Skin diseases such as Actinic keratosis, Atopic Dermatitis, Benign keratosis, Dermatofibroma, Melanocytic nevus, Melanoma, Melanoma, Tinea Ringworm Candidiasis and Vascular lesion are very confusing to detect by human eyes. This project will help the humans for detecting the diseases by themselves using a website. People can upload the suspicious skin images and the application can detect the disease and will suggest them the basic treatments and near by hospitals for treating diseases. This work is utilizing the efficiency of Convolutional Neural Network and transfer learning for image classification and detection and making it available to the society. Also, ensure security for the data, which they are uploading. These are a common health concern worldwide, and their early detection is crucial for effective treatment. To improve the accuracy of the classification process, a novel feature extraction technique is employed. The proposed approach is evaluated on a publicly available dataset and compared to existing methods. Results demonstrate the effectiveness of the proposed approach, achieving a higher accuracy rate than existing methods. The proposed approach has the potential to assist dermatologists in accurate and timely diagnosis of skin diseases.

Keywords*:* Skin, Detect, Skin Disease, Data, Neural, Health, Machine Learning, Human Eyes, Actinic Keratosis, Atopic Dermatitis, Benign Keratosis, Dermatofibroma, Melanocytic Nevus, Melanoma, Melanoma, Tinea Ringworm Candidiasis And Vascular Lesion.

1. INTRODUCTION

Skin diseases are a widespread medical condition that affects millions of people worldwide, causing discomfort, pain, and sometimes even life-threatening conditions. With the development of technology, machine learning has become a viable option for the precise identification and classification of skin diseases. Automated systems that can evaluate skin imaging data and provide precise diagnoses can now be created using machine learning algorithms, helping dermatologists to deliver quicker and more precise treatments. The detection and classification of skin diseases using machine learning algorithms has been the subject of numerous studies in recent years.

Deep learning methods like transfer learning and convolutional neural networks (CNNs) have demonstrated promising results in the detection and classification of a variety of skin disorders. These algorithms may be taught to recognise patterns and features that are distinctive of various skin conditions by subjecting them to a large number of annotated skin photos during training.The quality of care given to patients with skin disorders can be greatly enhanced by the creation of an accurate and dependable machine learning-based system for skin disease diagnosis and categorization. Additionally, it can aid in the early diagnosis of skin malignancies, increasing the likelihood that they will respond favourably to therapy.

In order to create more reliable and precise algorithms for the diagnosis and categorization of skin diseases, there is a rising need for additional study in this area.Skin conditions are a complex medical issue that can be brought on by a number of things, including heredity, environment, way of life, and exposure to specific chemicals. Accurate diagnosis is essential to delivering successful therapy because the symptoms and severity of many illnesses can differ greatly.In the past, dermatologists have relied on subjective and time-consuming methods like eye examination and medical history to identify skin illnesses. Machine learning algorithms, on the other hand, can offer a more accurate diagnosis more quickly, which will benefit patients. A significant body of annotated skin image data is needed for the creation of a precise and reliable system for the diagnosis and categorization of skin diseases.These images need to be diverse and representative of different skin types and conditions. Once the dataset is prepared, machine learning algorithms can be trained using various techniques such as transfer learning and data augmentation to improve their accuracy and generalizability.

The trained algorithms can then be deployed in clinical settings to assist dermatologists in making accurate and efficient diagnoses. Machine learning algorithms is a promising field that has the potential to improve the quality of care provided to patients suffering from skin diseases. With further research and development, we have designed a web-based system for detecting the skin diseases by scanning face, body of any person. The website that we have designed is more accurate and reliable that can assist dermatologists in making faster and more accurate diagnoses.

2. LITERATURE REVIEW

Viswanatha Reddy Allugunti (2021) describe that One in five Americans may have skin cancer in their lifetime. It will be considered as the common disease in the world. It accounts for 7% of all newly diagnosed cases of cancer globally and causes 1.79% of the disease burden measured in disability-adjusted life years. Clinical evidence indicates that there are racial inequalities in skin cancer outcomes, with darker skin tones being associated with either a higher or lower mortality risk for particular melanoma subtypes. The best qualified dermatologists to make an accurate diagnosis are those who have received extensive training on the many skin lesions that melanomas may cause. With the use of their combined mathematical expertise, this study discovered that Deep Learning models were the most advanced way to achieve the desired results, and they created a Dense Convolutional Network with an accuracy of 86.6%. Using Deep Learning, a strong and effective subfield of artificial intelligence, this model was able to categorise images effectively and accurately. Here, CNN model is used for high projected accuracy and minimal computing effort for the diagnosis of skin cancer. It is only tested on one dataset, though. [1]

Manuel et al. (2023) describe that Patients with non-dermatological disorders have been shown to have worse outcomes and a lower quality of life when they have a type D personality. Skin disease patients were more likely to have type D personality than were controls, and it was discovered that this personality type was linked to lower life satisfaction and increased rates of psychiatric comorbidities. [2]

Mingjun Wei et al. (2023) describe that A serious public health issue affecting a broad population is skin disease. Ordinary people sometimes ignore changes in their skin's symptoms because it is challenging to tell what kind of skin illness they are dealing with simply by looking at it. Due to its greater robustness and superior capacity to generalise, deep learning has emerged as the method of choice for medical picture analysis. A lot of progress has been made in the classification of medical images using convolutional neural networks. This model outperformed the baseline model in terms of sensitivity, with a score of 91.6% on the ISIC2017 dataset. FixCaps, a capsule network technique proposed by Lan et al., with a f1-score of 86.36% and an accuracy of 96.49%. As the main sub-classification models, DenseNet201 and ConvNeXt L were chosen, and Efficient Channel Attention and Gated Channel Transformation were added as fundamental blocks. Several tests were run to compare the suggested model to other cutting-edge models, and the findings showed that the model is accurate and capable of being generalised. In this study, a convolutional neural network model based

on model fusion was developed for the classification of skin diseases, with DenseNet201 and ConvNeXt L serving as the main sub-classification models. An attention module was added to the network model to improve its ability to extract picture features, and a parallel approach was used to combine the features of the deep and shallow layers. In comparison to the two baseline models, the proposed model's accuracy was 96.49%, 4.42%, and 3.66% higher. [3]

Pravin R. Kshirsagar et al. (2022) describe that The skin, which shields our internal organs and tissues from hazardous bacteria, pollution, and sun exposure, is the main component of the human body. Skin conditions can seriously affect one's life and health. The structuring and implementation of a skin observation early years foundation identification of skin disorders have been made possible by technological advancement. One of the fields that can substantially help with the practical and accurate detection of a variety of skin problems is deep learning. Nowadays, the skin irritation syndrome is manually diagnosed using a variety of histological traits.By applying deep learning techniques to analyse the microscopic image, findings are more reliable than visual symptom-based diagnoses. [4]

Omkar Narayan et al. (2020) describe that Artificial intelligence is replacing automation in healthcare, increasing the risk of developing skin cancer, which is brought on by unprotected exposure to UV radiation. The survey's findings show that the back and lower extremities, trunk, and upper extremities are severely affected by skin cancer, with a high prevalence of patients between the ages of 30 and 60. Although though skin conditions are the fourth most common cause of sickness in people, many people still avoid seeing a doctor. This research proposes a reliable and automated method for the identification of dermatological illnesses, which, when detected early, is more efficient and less disfiguring. An overview of the system and implementation approach is provided, and AI or ML is shown to be superior to skilled dermatologists. [5]

Ehsan Y. Bashandy et al. (2023) describe that An infection spread by blood-feeding insects is called Lumpy Skin Disease (LSD). It resists inactivation and has a lengthy shelf life at room temperature. With morbidity ranging from 3-85% and mortality ranging from 1-40%, it poses a severe endemic risk to populations of cattle throughout the Middle East and Africa. Infection with LSD is probably brought on by contaminated water and food. Although sick animals can be isolated and put to death, mass vaccination is the most effective method of disease management. An analysis of LSD outbreaks that occurred in Egypt between 2006 and 2018 was done retrospectively, and a survey was done to identify any associated risks. In Egypt, LSD is endemic, and cleanliness and biosecurity violations have increased the disease's prevalence. The practical pillars against it are increasing disease awareness and implementing preventative and control measures. [6]

Tsugunobu et al. (2023) describe that As a plant alkaloid with anti-inflammatory and antioxidant properties, berberine is a key ingredient in Oregedokuto, a traditional herbal remedy used to cure skin conditions that won't go away. Symptoms like dry mouth, hot flashes, sweating, inflammation, and itching are frequently improved by using it. By the suppression of inflammatory-related factors, induction of anti-inflammatory factors, and prevention of epidermal hyperplasia, berberine reduces skin inflammation. [7]

Gita Dwi Prasasty describes that The ectoparasite Sarcoptes scabiei, which is a member of the group Acarina, is what causes scabies in people and mammals. According to Liuetal (2016), it is very common in underdeveloped nations with tropical weather and excessive humidity. Following East Asia, Southeast Asia has the second-highest prevalence of scabies according to the 2015 Global Burden of Disease, with Indonesia coming in top out of 195 nations (Karimkhani et al. 2017a). According to Zayyid et al. (2010), scabies spreads through close intrapersonal skin contact, poor personal hygiene, low socioeconomic position, and inappropriate sexual behaviour in crowded populations. Bacterial infections are the most common skin damage problem associated with scabies. Systemic infections caused by Streptococcus pyogenes and Staphylococcus aureus include acute

poststreptococcal glomerulonephritis (APSGN), rheumatic fever, and rheumatic heart disease. In light of this, scabies can result in morbidity measured by disability-adjusted life year (DALY) and even mortality (Karimkhanietal.2017a,b).Scabiesisalsoassociatedwithintellectualdisability(Liuetal.2017b). Scabies has also been linked to IL-17, a proinflammatory cytokine released by the immune system. In persons with autoimmune diseases including psoriasis and rheumatoid arthritis, it plays a critical role in the immunopathology of scabies (Karimkhani et al. 2017a; Liu et al. 2017a). Accurate diagnosis is crucial because of the high prevalence and deadly effects of scabies. Currently, the diagnosis is made if two of the four cardinal symptoms are present: nocturnal pruritus, living in a crowded environment, characteristic lesions and predilections, and microscopic positive (found mites, eggs, or schistosomes). A diagnosis is made in up to 65% of instances, although the rest of patients have a variety of undiagnosed lesions (Hongetal. 2010; Sule and Dankyau 2015). Dermoscopy-oriented nested PCR of CO1 and ITS2 could successfully identify S. scabiei infestations, with ITS2 being more sensitive than CO1, and could be regarded a viable molecular identification tool and screening marker of ordinary scabies. The sequencing analysis revealed multiple species variants in these genes (accession numbers KJ748523 and AB778919). [8]

Sau Huu Nguyen describes that The study aims to investigate how various skin illnesses affected people's health-related quality of life (HRQOL) in Vietnam. The findings revealed that patients with warts had the greatest HRQOL and patients with psoriasis had the lowest HRQOL, with warts patients having the highest HRQOL and psoriasis patients having the lowest HRQOL. This study is significant because it offers a framework for creating contextualised, person-centered therapies that may be more effective at producing results. Drawing conclusions from the findings will help with the creation and application of suitable care and therapy. This study aims to investigate how various skin illnesses affected people's health-related quality of life (HRQOL) in Vietnam. The findings revealed that psoriasis patients had the lowest HRQOL and warts patients the highest, with Patients with warts have the highest HRQOL, whereas those with psoriasis have the lowest. This study is significant because it offers a framework for creating contextualised, person-centered therapies that may be more effective at producing results. Drawing conclusions from the findings will help with the creation and application of suitable care and therapy. Warts and psoriasis are the two skin conditions in Vietnam with the lowest HRQOL. [9]

Agus Trianto describes that Globally, the increased incidence of MDR infections has resulted in up to 700,000 fatalities. The pathogens of MDR skin diseases have been identified as Propionibacterium acnes, Staphylococcus epidermidis, and Candida albicans. Applying antibiotics to the diseased area is the most typical treatment for these disorders. However, the rise of MDR skin pathogens will be caused by the misuse of antibiotics in conjunction with inadequate treatments. Nudibranch-associated bacteria can be employed as a source of novel antibacterial chemicals to get over this obstacle.This study intends to collect and evaluate the antibacterial abilities of bacteria linked to the Indonesian nudibranch Chromodoris lineolata against a variety of skin diseases as well as identify the presence of biosynthetic gene clusters (BGC) using a molecular method. The increase of MDR infections has resulted in 700,000 fatalities worldwide. The pathogens of MDR skin diseases have been identified as Propionibacterium acnes, Staphylococcus epidermidis, and Candida albicans. Applying antibiotics to the diseased area is the most typical treatment for these disorders. However, the rise of MDR skin pathogens will be caused by the misuse of antibiotics in conjunction with inadequate treatments.Nudibranch-associated bacteria can be employed as a source of novel antibacterial chemicals to get over this obstacle. This study intends to collect and evaluate the antibacterial abilities of bacteria linked to the Indonesian nudibranch Chromodoris lineolata against a variety of skin diseases. [10]

Mohammed Samannodi describes the disorders of the skin's appendages, skin and subcutaneous tissue infections, and other skin and subcutaneous tissue disorders. These were the most frequently diagnosed conditions. Male and female admission rates to hospitals rose by 60.2% and 51.9%,

respectively. The risk factors connected to infections, skin problems, and issues involving subcutaneous tissue need to be further investigated. [11]

A P Wijaya describes that a frequent ailment in emerging nations is skin disease, which affects 20%–25% of the population. Antibiotics are used to treat skin conditions, however overuse can result in the development of skin infections that are multi-drug resistant (MDR). Numerous marine resources in Indonesia, including nudibranchs and bacteria associated with nudibranchs, are potential sources of novel antibacterial substances. This work uses an antagonistic and molecular strategy to collect microorganisms associated with nudibranchs from Jepara, Central Java, Indonesia that have antifungal potential against Candida albicans. According to earlier research, Phyllidia varicose, a nudibranch, may be used as an antibacterial agent to combat Staphylococcus aureus and Shigella flexneri.A frequent ailment in emerging nations is skin disease, which affects 20%–25% of the population. Skin conditions are treated with antibiotics, however Multi-drug resistant (MDR) skin infections may appear as a result of excessive use. Indonesia offers a wealth of marine resources that could serve as a source of novel antibacterial substances, including nudibranchs and bacteria related to nudibranchs. [12]

Mikołaj Kamin´ski describes that Up to one-third of the world's population suffers from skin illnesses, making it one of the most prevalent medical conditions. Health-related information may now be found almost exclusively online, with Google being the most widely used search engine worldwide. This study looked at a number of skin conditions in different geographical areas to determine which clinical symptoms are the most upsetting ones based on the number of Google searches made about them to uncover regional variances and seasonal variations. Google is becoming more popular as a resource for dermatological issues; experts should suggest trustworthy websites. [13]

Tomislava Skuhala skin describes in retrospective study evaluated the quantity and type of skin disease among patients at a tertiary care university affiliated teaching hospital over a three-year period. The most common infectious diagnoses were chickenpox, herpes zoster and unspecified viral infections. The most individuals were diagnosed with "nonspecific skin eruption" (n = 4448). [14]

Corrado Giua describes that Community pharmacists are a valuable source for information about dermatological problems and self-management help. 154 community pharmacists in Italy completed a semi-structured survey to identify knowledge gaps and false beliefs. Pharmacy professionals developed a bad opinion of topical corticosteroid therapy, underlining the dangers for patients' adherence. This study presents qualitative information on pharmacists' knowledge of dermatology, the types and frequency of illnesses that are reported to pharmacies, knowledge gaps, and the educational resources needed to close those gaps. The information gathered by SIFAC could be utilised to create standardised methods for dealing with dermatitis in the pharmacy context. [15]

Overview

Skin disease is most now a days. This model can help to get an idea of disease if user seem to have some symptoms regarding skin diseases.

First, we selected data set for this project from Kaggle website. Dataset contains 9 diseases they are as Actinic keratosis, Atopic Dermatitis, Benign keratosis, Dermatofibroma, Melanocytic nevus, Melanoma, Melanoma, Tinea Ringworm Candidiasis and Vascular lesion.

Now the next step, to build a transfer learning model using pre-existing models. Image data generator images are pre train in specific size i.e., 224*224. In transfer learning, models are reusing pre-trained model for new problem.

Input in image on webapp then models classify the disease. Web app will display disease name as well as their cure and treatments.

3. PROPOSED METHODOLOGY

The methodology of a skin disease by scanning face website using machine learning algorithms typically involves the following steps:

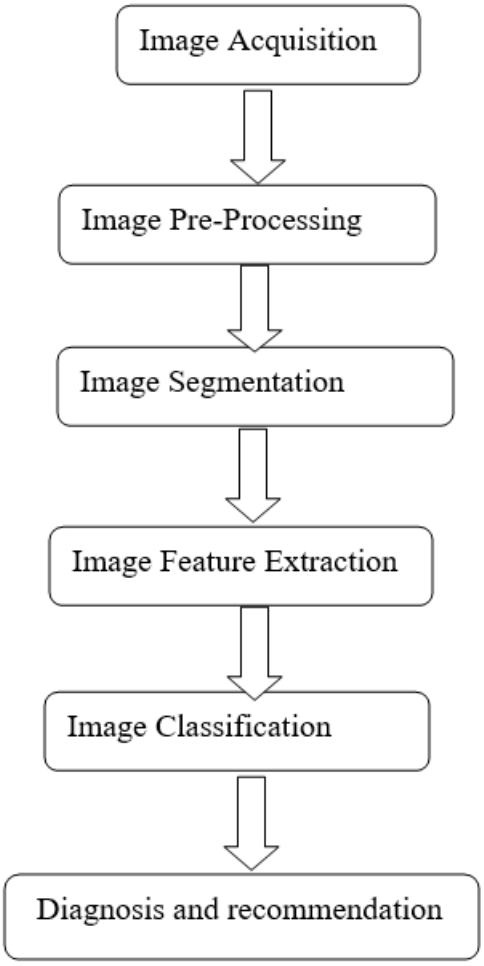

Figure: 1 Overall Research Flow

Phase:1 User uploads an image: The user uploads an image of their face to the website.

Phase:2 Image pre-processing: The uploaded image undergoes pre-processing to enhance the quality and remove any noise or artifacts. This may involve operations such as resizing, colour normalization, and feature extraction.

Phase:3 Skin lesion segmentation: The image is then segmented to isolate the area of the skin where the suspected lesion is present. This may be achieved using image processing techniques such as thresholding, morphological operations, and machine learning algorithms.

Phase:4 Feature extraction: Features are extracted from the segmented skin lesion area to create a set of inputs for the machine learning algorithm. These features may include colour, texture, shape, and size of the lesion.

Phase:5 Classification: The machine learning algorithm then classifies the input image into a particular skin disease category based on the learned patterns and characteristics. The classification

may be binary, where the image is classified as either having or not having a particular skin disease, or multiclass, where the image is classified into one of several different skin disease categories.

Phase:6 Diagnosis and recommendation: Based on the classification, the website then provides a diagnosis and recommended course of action for the user. This may involve suggesting the user seek further medical attention or providing information on treatment options and preventative measures.

Overall, the skin disease by scanning face website using machine learning algorithms provides a fast and accessible way for individuals to receive a preliminary diagnosis of their skin condition and seek appropriate medical attention.

Pseudo code:
Data Set Source: Kaggle.com
Data set: 878 Images
Training Data Set: 697 Image belongs to 9 classes.
Testing Data Set: 181 Image belongs to 9 classes.
Step:1 Input Image
Step:2 Pre-Processing: Resize Image to 224x224, and images undergo RGB colour conversion.
Step:3 Segmentation: Background separation using thresholding techniques.
Step:4 Feature Extraction: colour, texture, shape, and size of the lesion are extracted.
Step:5 Classification: Diseases are classified Actinic keratosis, Atopic Dermatitis, Benign keratosis, Dermatofibroma, Melanocytic nevus, Melanoma, Melanoma, Tinea Ringworm Candidiasis and Vascular lesion using CNN and various models of transfer learning models in machine learning.
Step:6 Diagnosis and recommendation: Recommendations are done using Decision Tree.

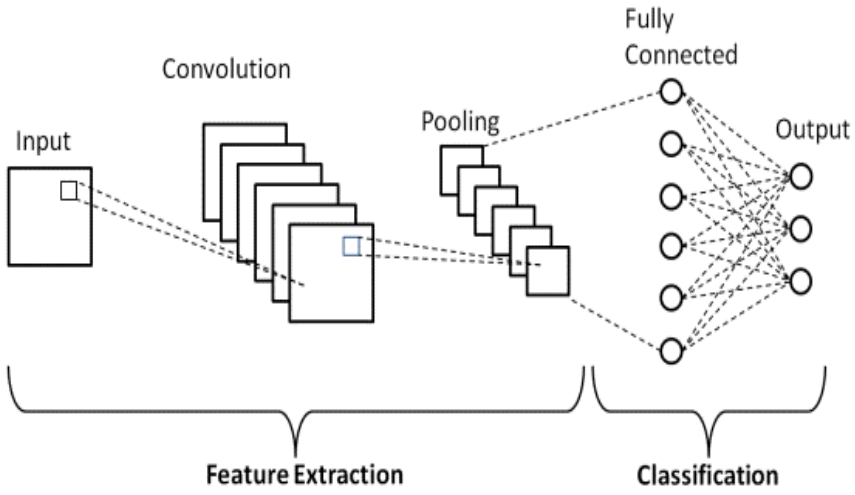

Fig. Architecture of CNN model.

4. RESULT AND DISCUSSION

In this project we use three models for skin disease image classification.

1.CNN: In CNN (Convolutional Neural Network) model use layer such as Convolutional layers, pooling layers, flatten and dense layers. Their are total 9,568,649 params ,we train params to 9,568,649 and non training params where 0.

Train our model up to 20 epochs, model gives us accuracy of 69%. Accuracy was not too good, because we want more accuracy for predications. Result we get in this model indicate graph of accuracy and loss indicating train and valid dataset on x and y axis respectively.

Fig. Graph 1(CNN)

2.Resnet 50: In this model their were total 25,695,113 params, trainable params where 2,107,401 and non-trainable where 23,587,712.

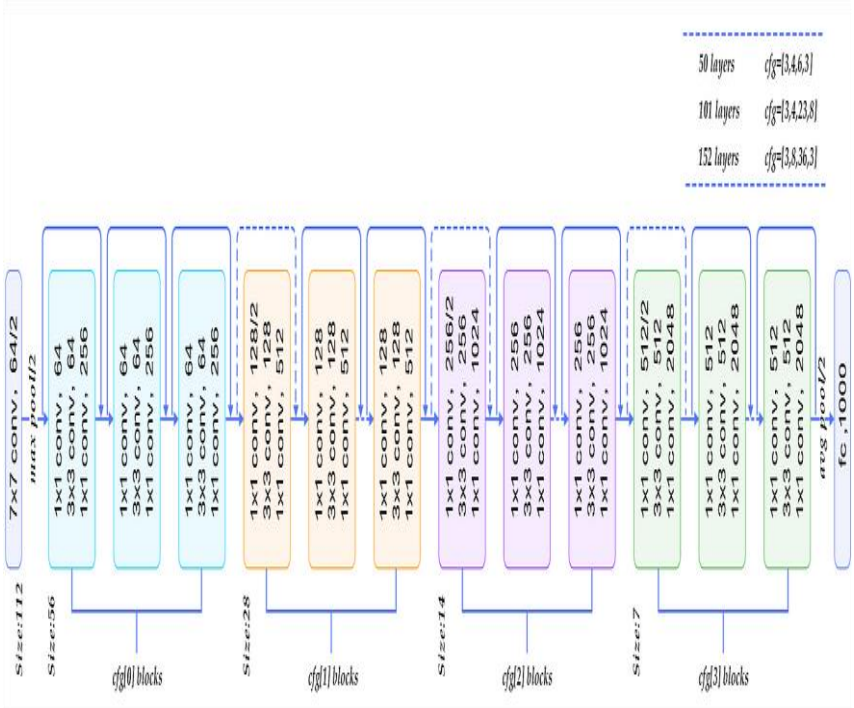

Fig. Architecture of ResNet50 model.

The accuracy of this model was only 13%. Which not good at all for our project. ResNet50 model was not suitable for our image classification. The graph of accuracy and loss indicating train and valid dataset on x and y axis respectively.

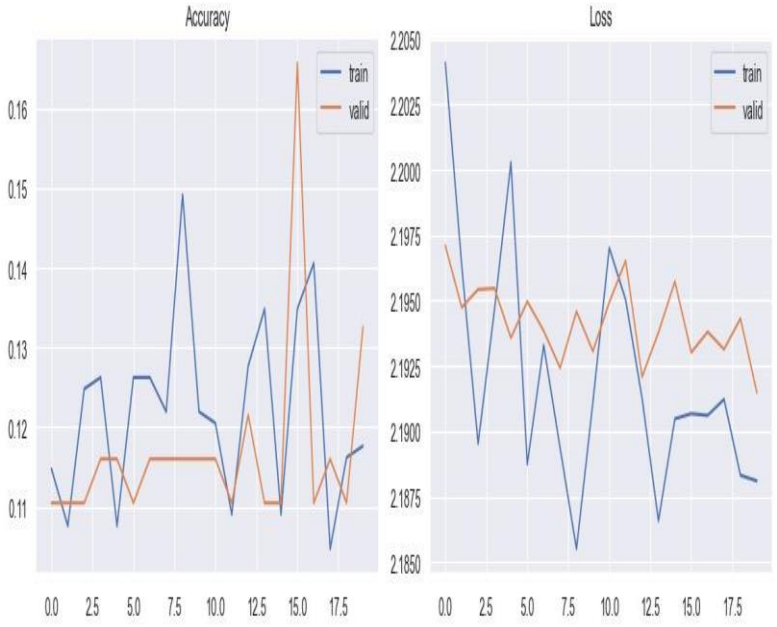

Fig.Graph 2(ResNet50)

3.MobileNet: Separable Convolution layers are the prime source to build MobileNet. Each model consists of 28 layers. A standard MobileNet has 4.2 million parameters. The size of the input image is 224 × 224 × 3.

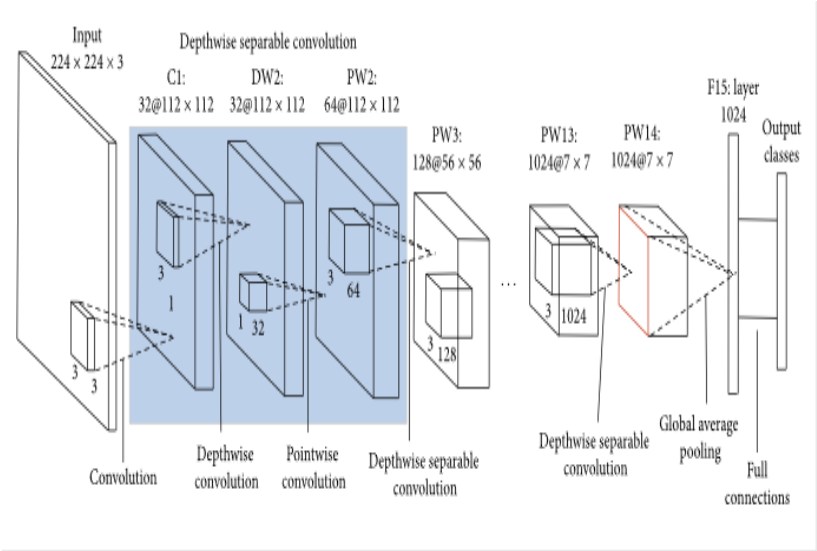

Fig. Architecture of MobileNet model.

There were total 4,287,689 params, trainable params where 1,058,825 and non-trainable where 3,228,864. This model perfectly fit for our project. Accuracy of this model was 96% which is very good for our project. We save this model and use for skin disease image classification.

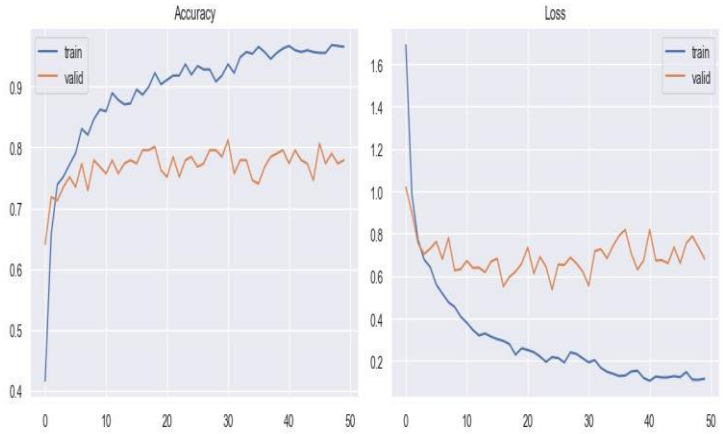

Fig.Graph 3(MobileNets)

5. CONCLUSION

Transfer learning and Convolutional Neural Networks (CNNs) are best approach for the skin disease image classification . There are many diseases in skin diseases which can further classified using various models of transfer learning and CNN. This models help in classification of Actinic keratosis, Atopic Dermatitis, Benign keratosis, Dermatofibroma, Melanocytic nevus, Melanoma, Melanoma, Tinea Ringworm Candidiasis and Vascular lesion only ,future scope for this model is to add more diseases.

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