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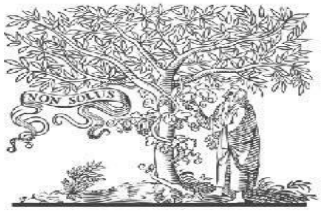

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CLASSIFICATION OF SKIN DISEASE USING DEEP LEARNING

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Abstract

Skin disease detection using deep learning is an emerging field of research that aims to improve the accuracy and efficiency of skin disease diagnosis. Deep learning algorithms, particularly Convolutional Neural Networks (CNNs), have shown promising results in detecting various types of skin diseases from images. The process involves training a deep learning model using a large dataset of labelled skin disease images and then using the model to classify new images into their respective disease categories. Several research papers have proposed different deep learning-based approaches for skin disease detection using various techniques such as CNNs, GANs, and auto encoders. While the results of these studies are promising, more research is needed to further refine and optimize the algorithms and to ensure their generalizability and reliability in real-world clinical settings. Overall, skin disease detection using deep learning has the potential to revolutionize the field of dermatology and improve patient outcomes by providing an accurate and efficient diagnosis. Deep learning algorithms, particularly Convolutional Neural Networks (CNNs), have shown promising results in detecting various types of skin diseases from images.

The process involves training a deep learning model using a large dataset of skin disease images labelled with their corresponding disease types. The trained model can then be used to classify new images into their respective disease categories.

Keywords: CNN, SKIN DISEASE CLASSIFICATION, DEEP LEARNING, PYTHON

1.Introduction

Skin diseases are common and can have a significant impact on an individual's quality of life. Early and accurate diagnosis is crucial for effective treatment and management of skin diseases. However, skin disease diagnosis can be challenging due to the large number of disease types, variations in disease presentation, and the subjective nature of visual inspection. Traditional diagnostic methods rely on visual inspection by

dermatologists, which can be time-consuming, costly, and subject to inter- and intra-observer variability.

In recent years, deep learning algorithms have shown great promise in improving skin disease diagnosis. These algorithms are particularly effective at analysing large datasets of images and identifying patterns that can be difficult for humans to detect. Convolutional Neural Networks (CNNs) are a type of deep learning algorithm that has been particularly successful in detecting and classifying skin diseases from images.

Skin disease detection using deep learning has several potential benefits, including improved accuracy and speed of diagnosis, reduced inter-observer variability, and cost-effectiveness. This approach has the potential to revolutionize the field of dermatology by providing accurate and efficient diagnosis of skin diseases.

However, there are also challenges to overcome in implementing deep learning-based approaches for skin disease detection, such as the need for large, diverse datasets, and the need to ensure the reliability and generalizability of the algorithms. Despite these challenges, the potential benefits of skin disease detection using deep learning make it an exciting area of research with great potential for improving patient outcomes.

2. Literature Survey

A brief literature survey is given below.

Ercal et al. [1] used an adaptive colour metric from the RGB planes. It helps in discriminating the tumour and the background. Image segmentation is performed using a suitable coordinate transformation. Borders are drawn by extracting the tumour portion from the segmented image. This was an effective method to find tumours diagnosis.

Demyanov et al. Machine Learning Algorithms based Skin Disease Detection Shuchi Bhadula, Sachin Sharma, Piyush Juyal, Chitransh Kulshrestha Machine Learning Algorithms based Skin Disease Detection 4045 PublishedBy:Blue Eyes Intelligence Engineering & Sciences Publication Retrieval Number: B7686129219/2019©BEIESP DOI: 10.35940/ijitee.B7686.129219 [2] used deep convolutional neural networks, image classification algorithms with data augmentation to successfully investigate automatic detection of dermoscopic patterns and skin lesion analysis.

giving skin monitoring frameworks which are progressively exact, low cost and reliable.

3. Problem Identification

Skin diseases can cause a variety of problems for individuals, including physical discomfort, emotional distress, and potential health complications. Some common problems associated with skin diseases include:

1.Itching and discomfort: Many skin diseases can cause itching, burning, and

discomfort, which can be distracting and interfere with daily activities.

2.Visible symptoms: Skin diseases often cause visible symptoms such as rashes, bumps, or discoloration, which can be embarrassing or affect self-esteem.

3.Infection: If left untreated, some skin diseases can lead to infection, which can be more serious and require medical intervention.

4. Proposed Methodology

We propose an automated image-based system for recognition of skin diseases using machine learning classification. This system will utilize computational technique to analyse, process, and relegate the image data predicated on various features of the images.

5. Implementation

The implementation of a skin disease detection system using deep learning involves several key steps:

1)Data Collection: The first step in implementing a skin disease detection system using deep learning is to collect a large and diverse dataset of skin disease images. The dataset should include images of various skin diseases, skin types, ages, and ethnicities.

2) Data Preparation: The collected data needs to be pre-processed to ensure that it is suitable for training a deep learning model. This includes resizing the images, converting them to grayscale or RGB, and labelling them with their corresponding disease type.

3) Model Training: The next step is to train a deep learning model using the pre-processed data. The model should be designed using a suitable architecture, such as a Convolutional Neural Network (CNN), and trained using a large and diverse dataset. The training process involves iteratively adjusting the model's parameters to minimize the error between the predicted and actual disease types.

4) Model Evaluation: After training, the model needs to be evaluated to determine its accuracy in detecting and classifying skin diseases. This involves testing the model on a separate dataset of skin disease images and comparing its predictions to the actual disease types.

5) Deployment: Once the model has been trained and evaluated, it can be deployed as a skin disease detection system. This can involve integrating the model into a web or mobile application, or integrating it with existing dermatology software systems.

5) Maintenance and Updates: The final step is to maintain and update the system over time. This includes monitoring the system's performance, updating the model with new data as it becomes available, and continuously improving the system's accuracy and usability.

Overall, implementing a skin disease detection system using deep learning

requires careful attention to data collection, pre-processing, model training, evaluation, deployment, and maintenance. With proper implementation and continuous improvement, a deep learning-based skin disease detection system has the potential to significantly improve skin disease diagnosis and treatment.

Prerequisites

Implementing a skin disease detection system using deep learning requires several key prerequisites:

1) Understanding of Deep Learning: A solid understanding of deep learning algorithms and neural network architectures is necessary to design and train a deep learning model for skin disease detection. This includes knowledge of back propagation, gradient descent, activation functions, loss functions, and optimization techniques.

2) Proficiency in Programming Languages: Proficiency in programming languages such as Python is essential for developing and implementing the skin disease detection system. In addition, familiarity with deep learning libraries such as Tensor Flow or Keras is necessary.

3) Familiarity with Skin Diseases: Knowledge of skin diseases and their various presentations is essential for accurately labelling the collected dataset and evaluating the model's performance. This may require collaboration with dermatologists or other medical professionals.

4) Access to Diverse and Labeled Data: A large and diverse dataset of labeled skin disease images is necessary for training a deep learning model for skin disease detection. This may require collaboration with medical institutions or other sources of data.

5) Computing Resources: Implementing a skin disease detection system using deep learning requires significant computing resources, including high-performance GPUs or cloud-based services. This is necessary for training the deep learning model and deploying the system.

6)Ethical Considerations: The use of deep learning algorithms for skin disease detection raises ethical considerations, such as ensuring patient privacy, obtaining informed consent, and avoiding bias in the model's predictions. Therefore, it is essential to consider ethical issues in the design and implementation of the system.

Overall, implementing a skin disease detection system using deep learning requires a combination of technical expertise, domain knowledge, and access to appropriate resources. It is important to carefully consider these prerequisites before embarking on a deep learning-based approach to skin disease detection.

Convolutional Neural Networks (CNN):

(CNN) are a popular deep-learning architecture used in skin disease detection systems. CNNs are well-suited for image classification tasks because they can automatically learn the features of an image and use them to accurately classify the image into one or more classes.

Architecture of a CNN includes multiple layers, including convolutional layers, pooling layers, and fully connected layers. The convolutional layers are responsible for extracting features from the input image by convolving a set of learnable filters over the image. The pooling layers are used to down sample the features and reduce the dimensionality of the image representation. The fully connected layers are used to classify the image based on the extracted features.

In the context of skin disease detection, a CNN-based approach typically involves the following steps:

Input Image: A skin disease image is inputted into the CNN.
Convolutional Layers: The convolutional layers of the CNN convolve a set of filters over the image to extract relevant features.
Pooling Layers: The pooling layers down sample the extracted features to reduce the dimensionality of the image representation.
Fully Connected Layers: The fully connected layers of the CNN classify the image based on the extracted features.
Output: The CNN outputs a predicted skin disease type based on the image.
Training: The CNN is trained on a large and diverse dataset of skin disease images, using a loss function to minimize the error between the predicted and actual disease types.
Validation and Testing: The CNN is validated and tested on a separate dataset of skin disease images to evaluate its accuracy in detecting and classifying skin diseases.

Overall, a CNN-based approach to skin disease detection has the potential to significantly improve the accuracy and speed of skin disease diagnosis. With appropriate training and evaluation, a CNN can accurately classify a diverse range of skin diseases and enable more efficient and effective treatment.

Algorithmic steps for CNN:

Here are the basic algorithmic steps for a Convolutional Neural Network (CNN):

Input: The first step is to take the input image and pre-process it. This may include resizing, normalization, and centering.

Convolution: The input image is then passed through a series of convolutional layers. Each layer uses a set of filters to extract features from the input image.

Activation: After each convolutional layer, a non-linear activation function (such as RELU) is applied to introduce non-linearity into the model.

Pooling: A pooling layer is then applied to reduce the spatial dimensions of the output volume while preserving important features. Common pooling methods include max pooling and average pooling.

Fully Connected Layers: The output of the last pooling layer is then flattened and passed through one or more fully connected layers to classify the input image.

Output: The final layer of the CNN produces a probability distribution over the different classes. This can be used to make a prediction about the input image.

Training: The CNN is trained using back propagation to adjust the weights of the filters and fully connected layers to minimize a loss function. This is typically done using stochastic gradient descent (SGD) or a variant of it.

Testing: Once the CNN is trained, it can be used to classify new input images. During testing, the CNN takes an input image, performs the forward pass, and outputs a probability distribution over the different classes. The predicted class is typically the one with the highest probability.

Case Study

One example of a skin disease detection and classification using deep learning case study is the work done by Esteva et al. in 2017. They developed a deep learning algorithm called the "dermatologist-level classification of skin cancer" (DLS-CNN) that was trained on a dataset of over 130,000 skin images.

The dataset included images of three common skin cancers (basal cell carcinoma, squamous cell carcinoma, and melanoma) as well as benign lesions and healthy skin. The images were pre-processed and augmented to balance the dataset and ensure that the algorithm was able to learn from all classes.

The DLS-CNN algorithm was able to achieve a performance level equivalent to that of 21 board-certified dermatologists in detecting skin cancer. In particular, it was able to correctly identify 95% of melanomas in the dataset, compared to 86.5% for the dermatologists.

This case study demonstrates the potential of deep learning algorithms for skin disease detection and classification, and highlights the importance of large and diverse datasets for training these algorithms. The high performance of the DLS-CNN algorithm also suggests that deep learning could be a valuable tool for dermatologists in improving the accuracy and efficiency of skin disease diagnosis.

6. Results & Conclusion

In this article Skin disease detection and classification using deep learning is an important and promising area of research that has the potential to revolutionize the diagnosis and treatment of skin diseases. Deep learning models have shown great success in accurately detecting and classifying skin diseases, even outperforming human experts in some cases.

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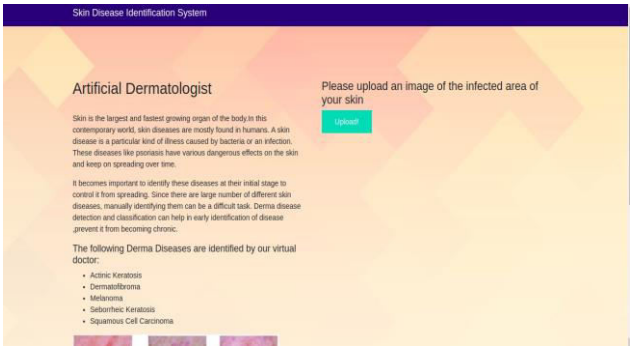

Fig.6.1.Output Screen After the execution of code

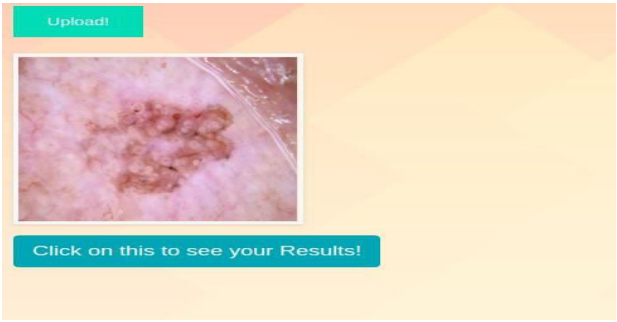

Fig.6.2.Upload an image using upload button

These models have the potential to improve access to healthcare for individuals who may not have easy access to dermatologists or other healthcare professionals trained in skin disease diagnosis. Additionally, these models can help reduce the time and cost associated with traditional diagnosis methods, while improving accuracy and reliability.

Fig.6.3.Click for result

However, there are still challenges that need to be addressed before these models can be widely implemented in clinical settings. One of the biggest challenges is the lack of diversity in the datasets used to train these models, which can lead to biased results.

Additionally, it is important to consider the ethical implications of using these models, such as ensuring patient privacy and autonomy. Despite these challenges, the potential benefits of using deep learning for are significant, and continued research in this area is essential to improving healthcare outcomes for individuals with skin diseases.

7. Limitations & Future Scope

Limitations are as below

1. Data Bias: One of the limitations of skin disease classification using deep learning is the potential for data bias. The accuracy of the model can be impacted by the quality and diversity of the dataset. Biased datasets can lead to models that perform poorly on certain skin types, age groups, or ethnicities.

2. Clinical Validation: The accuracy of the model on skin lesion images does not necessarily equate to clinical validity. Clinical trials and validation studies are needed to demonstrate the model's effectiveness in real-world scenarios.

Future Scope is as shown below

1. Transfer Learning: Transfer learning is a technique that allows pre-trained deep learning models to be repurposed for new tasks, enabling more efficient and effective model training with limited data. Transfer learning can be applied to skin disease classification to reduce the dependency on large, diverse datasets.

2. Mobile Applications: The integration of deep learning models into mobile applications could bring skin disease classification to the point-of-care. Mobile applications could enable patients to self-diagnose skin lesions and receive recommendations on when to seek medical attention, improving access to dermatological care.

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