International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 02 Issue: 01 January 2024
Page No: 14 - 19
https://irjaeh.com

Deep Learning Based Patient Care Mobile Application for Detecting Skin Cancer

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Abstract
Over time, skin cancer has become one of the most lethal malignancies in humans. Melanoma is the most dangerous type of skin cancer and is difficult to anticipate. Early identification is critical for maximising patients' chances of survival and preventing cancer from spreading to other areas of the body. It is very important to found and treat melanoma, before it spreads to the lymph nodes. So, the early finding is very vital. Skin cancer is normally diagnosed visually; it begins with physical examination, followed by dermoscopy, biopsy and histopathology, which takes several days. The major issue with melanoma is that, the disease can pave to some other cells. Laboratory sampling may cause the increase of lesion. Therefore, there must be an application that can perform the fastest, most accurate and cheapest diagnose. Computer based diagnosis can get better skin cancer diagnosis and it will work effectively to the disease symptoms. Our solutions will create a mobile cloud computing application that will take photos of the affected tumor and returns showing whether it is malignant or benign. Our solution will build a mobile application on cloud computing and it takes the pictures of affected skin tumors and gives result as whether it is affected as either Malignant or Benign.

Keywords: *Deep Learning; CNN; Machine Learning; Skin Cancer; Transfer Learning.*

1. Introduction
In human body, the largest organ is skin and skin cancer is one of the deadliest diseases globally. Skin cancer occurs in skin cells when skin grows abnormally while exposed to the sun. Cancer can affect people of all ages and can be fatal if not treated early. It has the highest mortality rate and the fastest growing, most alarming public health threat. Generally saying, there are three types of skin cancer: - Squamous cell carcinoma, basal cell carcinoma and melanoma. The latter, is the worst type of skin cancer, occurs in melanocytes, which produce melanin, the coloring agent for skin. The reports show that from past one decade, the increase in new melanoma cases is 65% high. If diagnosed at an advanced stage, the survival rate is less the 13 percent. The possibility of survival is 99% when we detect the cancer in earlier stage. This scenario urges for the early detection of skin cancer. Few common ways of the first sign of skin cancers can appear Include: A lump or patch which is not healing after many days, increasing or changing growth on the skin. Sometimes it looks like a rough or scaly red patch or a sore that developed in an old scar. In general, a dermatologist may perform a variety of tests such as a physical examination of the suspicious area, followed by dermoscopy, and finally a blood test. [1-5] This will take time and patients may progress to later stages. Reports show that even the best dermatologists have a less than 85 percentage accuracy rate in diagnosing skin cancer. Not only are we facing these problems, but there is also a worldwide lack of dermatologists in public health services. To diagnose skin cancer as early as possible, computer image analysis algorithms can provide the best solutions to the above skin cancer problems. These algorithmic solutions are parametric, requiring that the data be regularly distributed. Speed of skin cancer diagnosis can be

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increased by introducing computer based diagnose. This need was filled by Artificial Intelligence in Medical field and it plays vital role. Automated Artificial [6-9] Intelligence based systems can be developed by Machine Learning and Deep Learning algorithms. Numerous researches investigated about skin cancer analysis using various machine-learning methods. Many classifier skills were used in this machine learning algorithms. A large amount of computational time will be necessary to provide an accurate diagnosis. This study is about the diagnosis of skin cancer, which can help us find its type and better carry out the necessary prevention work for people's lives. Using Python and machine learning helps us understand how it works and all other process. Explaining the work at three levels helps us understand the entire process accurately and clearly.

2. Literature Review

In recent years, imaging has become increasing useful in skin cancer diagnostic studies. Many different and specific methods have been tried to diagnose skin cancer. ISIC is also reported that the server less mobile application can be easily used to detect cancer. Researchers are trying to improve the accuracy of skin cancer diagnosis by using various classification algorithms and techniques. With Fukushima and subsequent Le-Cunn's introduction of neural [10-13] network (CNN) architecture, image classification reached new frontiers. Alaa Haddad and Shihab A. Hameed proposed detecting skin illnesses by removing background noise and superfluous components. The study's findings can motivate doctors to use low-cost diagnostic tools to aid in initial diagnosis and understanding of illness types.Alaa Haddad and Shihab A. Hameed proposed detecting skin illnesses by removing background noise and superfluous components. The study's findings can motivate doctors to use low-cost diagnostic tools to aid in initial diagnosis and understanding of illness types. Afta et al. A three-stage in-depth study of the skin lesion is planned. To integrate local and global image enhancement, the authors first use the contrast of the dermoscopic image set and then perform image segmentation. They use transformational learning in their research to obtain learning properties and maps. Sultana et al. advice of CNN-based optimization has improved efficiency of graphics recommendation systems. As per the authors, CNN will help in significant developments in copy dispensation. [14-17] The writers were comparing CNN with other dimensionality reduction techniques, and found that CNN perform well with these approaches. Arik et al., Demir et al., Shihadeh et al., were trained and tested CNNs architecture on dermoscopy images to detect melanoma skin cancer. Namozov et al., review the role of activation in the distribution of skin diseases. Rahat Yasir et al. The computer vision model is for diagnosing skin diseases based on the images provided. Different preprocessing algorithms are used for feature extraction. Artificial Neural Networks (ANN) was used to train and test the data. Min Chen et al., suggests a model for skin cancer screening is [18-21] planned, including self-study information to establish a good relationship between users. De Angelo et al., suggested a model to filter the region of interest (ROI) of the lesions using Deep learning approaches. This work is based on segmenting the lesions border by applying Conditional Random Fields (CRF) algorithm as processing method to improve the segmentation.

3. System Architecture and Research Methodology

3.1. System Architecture

The system architecture (Figure 1) includes cloud platform and mobile applications. The cloud platform consists of Image preprocessor, CNN classifier and trainer, training database and post-processor. [22]

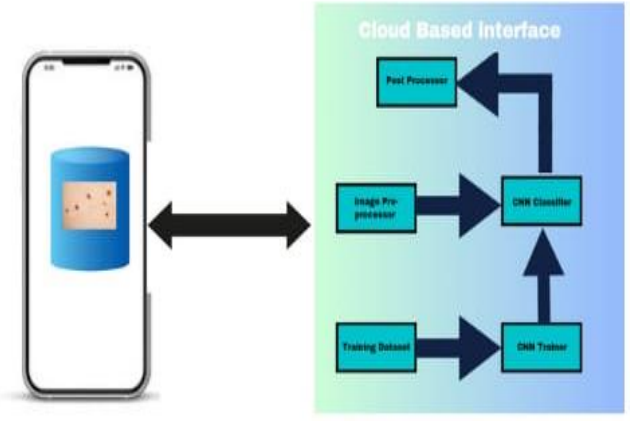

Figure 1 System Architecture

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Cloud based Mobile Application system:

- Users will be registered immediately when they log in first.
- When the photo of skin is uploaded to mobile application, the image will be sent for classification and analysis.
- After the data is loaded, the user must click on the "Classify" option for the CNN classification process.
- Detailed information will be produced after CNN's distribution.
- These reports will be stored in file as background information that users can view and can help doctors perform analysis.
- Users can also Email the doctors for a second opinion.

3.2. Research Methodology

Mobile Application consists of a simplified frontend which will be handled by the users to enter their information. Skin images can be captured by the mobile camera and these images can be uploaded to the Cloud platform for analysis. The uploaded image has to be not blurred and low quality, otherwise the result will not be accurate. In Image pre-processing stage, Cloud-based Python program is used to standardize the images for finding the type of skin cancer. A high-quality photograph provides the outcome promptly and aids us in improving accuracy. The background noise must then be eliminated to ensure that only a portion of the image is being used. This process must be done for all photographs and will continue until all images are totally ready to be processed. The user will get the diagnosis report whether the image is Malignant or Benign. [23] This application will email the results to doctor, is an added advantage to this mobile application. The cloud-based service uses CNN models to classify images. The CNN model will be trained using images of benign and malignant tumors retrieved from a reliable open-source repository. Depending on the type of skin cancer, individual images will be transferred to the folder. The images then need to be resized so the machine can understand them; This creates a folder containing the directory's resized images. This image must be converted to BGR-Gray and BGR-HSV so that the computer can recognise and read it in binary code. The cloud-based service uses a model learned by a CNN trainer to classify incoming images as good or bad. Find the mean of all distribution scores based on the total probability with the standard deviation of the parameters. Figure 2 shows the system design for skin cancer prediction. [24]

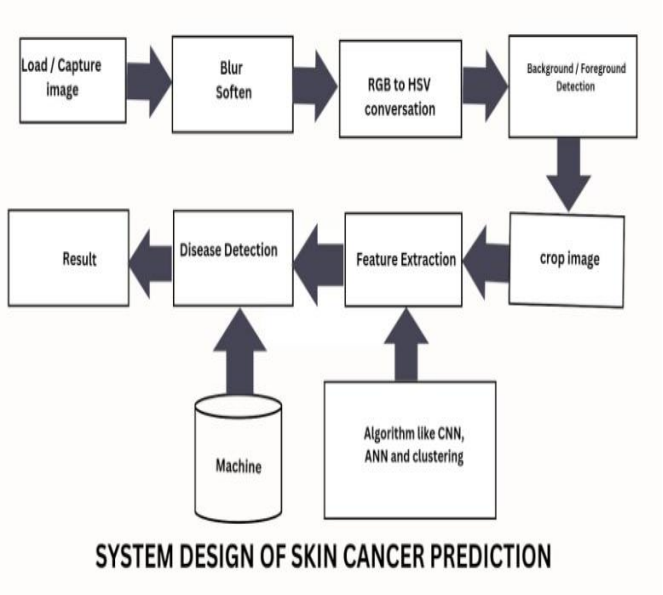

Figure 2 System Design of Skin Cancer Prediction

4. Deep Learning

Artificial neural networks (ANNs) are used in a sort of machine learning called deep learning. It can learn complex patterns and develop its own computer algorithms. In deep learning, there is no need to specify all. It became popular in recent years due to its strength and record. While machine learning uses simple concepts, deep learning works with neural networks designed to mimic human thought and learning. since deep neural networks, also known as artificial neural networks (ANN), are the foundation upon which it is built. Artificial neural networks, which have a network of connections between processes and information flow, are made to resemble the structure and operation of the human brain. The use of deep neural networks with several connection layers is the main component of deep learning. Deep neural networks may learn various patterns in data by identifying hierarchical patterns and characteristics. Deep learning algorithms can get

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adept at and advance through data without the need for administrative management. [25] Deep learning has made great progress in many fields, including image recognition, speech recognition, word processing and word recognition. Deep Belief Networks (DBN), Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN) are a few deep learning techniques. Training deep neural networks necessitate more data and resources. However, the ease of use of cloud computing and advances in dedicated hardware such as GPUs have made training deep neural networks less powerful.

4.1. Convolution Neural Network (CNN)

Convolutional neural networks (CNN) are a class of deep learning neural network architectures widely used in computer vision. Computer vision is an important skill that allows the computer to recognize and process images or visual data. Images obtained from the internet will be used as input, and the process of finding various features and patterns from the input image will continue. This different feature can be seen from the network. CNN captures the difference between space and time. These features are used to distinguish groups of images. The backbone of the CNN model is work experience. Three main layers are used to create the CNN model: convolution layer, voting layer and connected layer. The convolution kernel is the feature extractor of the convolution layer. The work of kernel is to slice the given image respective field, so that task can be done by kernel. [26]

4.2. Transfer Learning

Transfer learning of convolutional networks (CNN) has created a field called computer vision by reprocessing pre-trained models of new tasks. The impact of this process on learning from big data is very strong. This will help model training quickly and accurately using some level of registration information. Using CNN pre-training as elimination and fine-tuning network based on specific data. Transformative learning reduces the need for extensive learning time and computing resources. This project explores the concepts, applications, ideas, and implications of transfer learning using CNNs for a variety of computing tasks. The benefit of adaptive learning is that CNNs are trained on large datasets that learn general features relevant to many vision tasks. Instead of using the CNN from scratch on new data, instead of learning based on the previously trained CNN and updating it on new data. CNN is pre-trained as a specialized tool to capture high-visibility presentations. These features are then transformed into layers designed for occult work. While the new set is developed, the previously trained set remains unchanged throughout the refinement process.

5. Requirement Analysis

5.1. Software Requirements

Android 4.4 or above supports the installation of mobile applications on mobile phones; the application will capture the images of the affected skin and run the distribution over the internet.

Python: Python libraries such as OpenCv, Scipy and matplotlib will help us develop the system.

Cloud Services: Amazon Web Services (AWS) provides many services and tools which help us to store and accessibility of our data anywhere globally.

5.2. Hardware Requirements

Mobile camera: The images will be captured by the camera available in mobile and send them to the cloud for further distribution.

Internet Connectivity: Fastest internet connection is very important for the flawless operation of the application. Once the images were uploaded into the cloud, they need to be shared with cloud applications, which require network connection to make a link with the cloud.

Conclusion

This article describes the tools non-programmers need to develop deep learning models that will help shape the future of humanity. This article describes image classification, data analysis, and training to detect cancer cells. In the future, classification of cancer images may be further improved by adding algorithms that will make the results more efficient and effective.

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