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Selfie Based Early Detection of Breast Cancer

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Abstract

There is a huge growth of importance of artificial intelligence (AI) in medicine to improve diagnosis and treatment. Selfies, already a huge part of our daily lives, can help us detect many diseases. According to WHO , Breast cancer became the most common cancer globally as of 2021, accounting for 12% of all new annual cancer cases worldwide. It has become common cause of death in women around the world. A new tool has been adopted based on thermal imaging, deep convolutional networks, health applications on smartphones, and cloud computing for early detection of breast cancer.

We propose a System which suggests that people should provide their doctors with selfies that can be analyzed by deep learning machines configured to predict the presence and the particular stage of the disease. This is how importance of artificial intelligence (AI) and Deep Learning is growing in medicine.

I. Introduction

Among the most common type of cancer in India which is seen in women in today's scenario is breast cancer, where the reports of well-known hospitals in India have accounted 14% of cancers detected are breast cancer in women, it is seen that every four minutes a women is detected with this cancer both in rural and urban India. A 2018 report of Breast Cancer statistics recorded 1,62,468 new registered cases and 87,090 reported deaths.

Survival becomes difficult if the growth of cancer reaches more that 50% and seems to be entered in 3rd and 4th stage of cancer. Post cancer survival for women with breast cancer was reported 60% for Indian women, as compared to 80% in the U.S.

Early detection is better that the rate increases and is unavoidable to get solved, hence every women should have a self-diagnose their condition and know of the presence of lumps or masses that suggest cancerous outgrowths. The very reason for a low breast cancer survival rate of women in India accounts from its lack of awareness and poor early screening and diagnosis rates. Detection by screening mammography is usually associated with early-stage cancers, which are easier to treat and cure.

A study published on August 21 in the European Heart Journal has presented an innovative method for the widespread detection of heart disease. The new technology has taken away smartphone usage in a very different way. Communication and Service applications had led the complete setup to be benefited in healthcare system. The moto of

making all females self-responsible and even use in remote area made this activity to work in positive sense. Reports have proved that there are 600 plus applications for breast cancer diagnosis and treatment [1].

There was a study for comparing the deep learning and neural networks on devices which used for detecting breast cancer and their side effects. Wherein the deep learning was in much higher rate as compared to neural networks. This study made the mobile app to be installed in female mobile phones which would be helpful for self-detection by just taking a selfie [2].

Whereas in [3] they used a smartphone application for the breast cancer patients which had a 24 week follow up under age of 50 patients. It was a kind of psychological treatment for them by showing them various videos and games, chatting with them for positive analysis. This was a trail for knowing the psychology of patients and making them happy with use of smartphones.

The study in [4] had explained the various methods developing a Bewell Mobile app for treating patients with Breast Cancer. They have designed the app to gather patient's data, visual display for training, notification of upcoming visits and so on. This would give a customized information of the patient and was easy to use.

Similar study was done by [5], this was conducted on effects of Nurse-Led Support via WECHAT app, which was especially for breast cancer patients after surgery, where 60 patients were divided into groups ,each 30 in one group. The first 30 people were been checked continuously for 6 months through this app and in addistion other people participated in WECHAT based support Program (WSP) led by nurses. Wherein the pateints well being was been taken care. WSP assisted with nurse-led support and had physical, psychological, and social benefits for patients after BC surgery.

Technical based paper was also been read [6] where there was a comparison between high quality camera 640 * 480 pixels and a small thermal camera of 160 * 120 pixels . By Graying out the thermal images and they had extracted four features using GLCM Gray Level Cooccurrence Matrix. Later these were classified using KNN classifier which resulted 99.2% accuracy, which was the best among other algorithms. This camera in smartphones could prove to early screening of breast cancer and reduces costs and tiem for women to reach hospitals all time.

Use of a Smartphone with thermal camera is also studies in[7] where an image is clicked from thermal imager and transmitted to FPGA via Bluetooth ultra low power link and which is saved in SD card. Here the gray matrix co-presence (GLCM) features and run-length matrix (RLM) is calculated and Machine Learning classifier is used to early detect the stage of Cancer. These overall find the final result of breast cancer specificity of 79.06% and 88.57%, respectively using the above said algorithms.

II. Method of Self Detection

Early detection of Breast cancer can be done using a mobile app connected to the thermal camera. An overview of the complete setup shall be explained further.

1. Self-detection of breast cancer Overview:

This method includes using of mobile app,which helps us to detect breast cancer at early stage.the detail can be even explained through the diagrammatic representation shown in Figure1. We can illustrate the follow by having firstly training the Deep Convolutional Neural Network as a model inception MV4. Second, MATLAB is used to create a

Graphical User Interface Development Environment (GUIDE) for visual icons for proper interaction with users. Next we use deep convolutional neural networks for cloud computing for the intense computational requirements and large data processing. Fourth, we use the mobile application to send thermal images for cloud computing, receive diagnostic results, and display on users' smartphone screen. Moreover, a collection of thermal pictures was sent from the smartphone for cloud computing on completely different distances and strategies to verify the standard of the photographs as shown in Figure 2. Four effects on the thermal image (Blur, Shaking, Tilting, and Flipping) were more to verify detection accuracy.

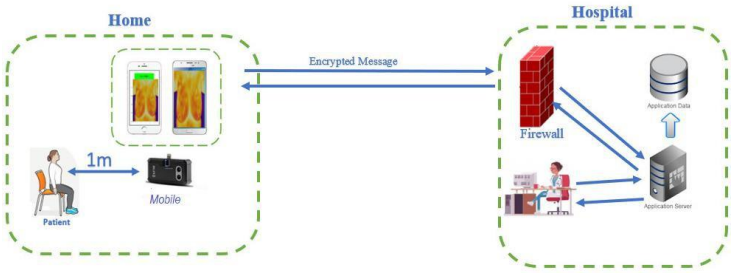

Figure 1. Self-detection of breast cancer based on smartphone application wit

Figure 2: Examination room thermal camera with one-meter distance from the chair

2. Deep Learning in Matlab

Deep learning has proven to be a branch of machine learning that uses deep convolutional neural networks to extract options directly from a info. Therefore, it achieves advanced classification accuracy that exceeds human performance. we have a tendency to used a deepconvolutional neural network consisting of 192 layers, Deep convolutional neural network training necessitates a collection of datasets containing thermal images of healthy and carcinoma people. The dynamic thermogram DMR-IR dataset was used to download

breast thermal images, and the learning rate was increased by loading the Deep Convolutional Neural Network model starting with MV4. The optimization process was chosen once the setting was changed.

We can divide the database into 70% for training and 30% for testing and trained the Deep Convolutional Neural Network Inception MV4,refer Figure 3 for the same.

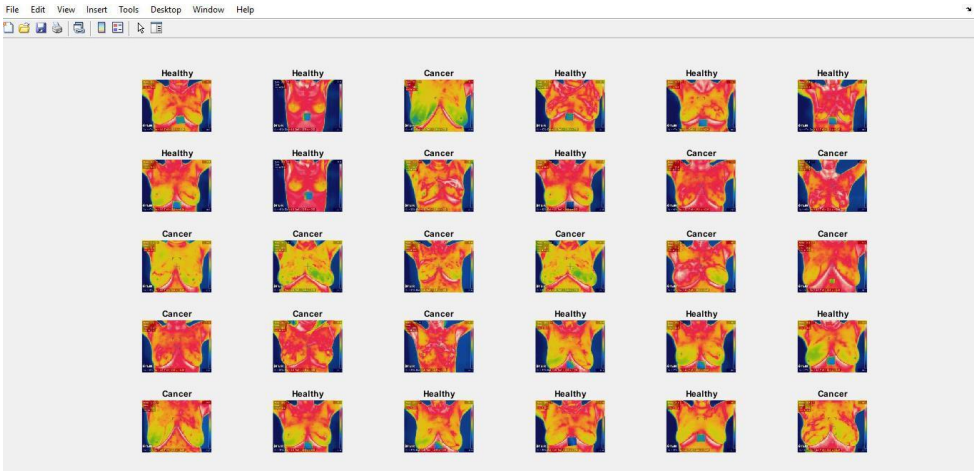

Figure 3: Thermal Images validated after training a deep convolutional neural network inception MV4

3. Graphical User Interface Development Environment (GUIDE) :

The graphical user interface has the benefit of being accessible to those who are unfamiliar with MATLAB. To make things easier for the user, the visual user interface is made up of icons like as buttons, scroll bars, windows, and boxes. Figure 4 shows a visual user interface with a separate area for displaying the thermal picture and displaying the diagnostic result. Auxiliary symbols for diagnosis, such as the patient's name, age, gender, and room temperature, have also been generated. In addition, before the examination, we included additional questions about the patient's condition, and there is an icon in GUIDE to reset all icons. In addition, we supplied two messages for the patient: "It is essential to pay a visit to a specialist clinic" if there is a suspicion of cancer, and "You are Safe" for other ailments, as shown in Figure 4. In addition, two files were included in the user interface: one for inputting the diagnostic thermal picture and the other for recording the diagnostic result.

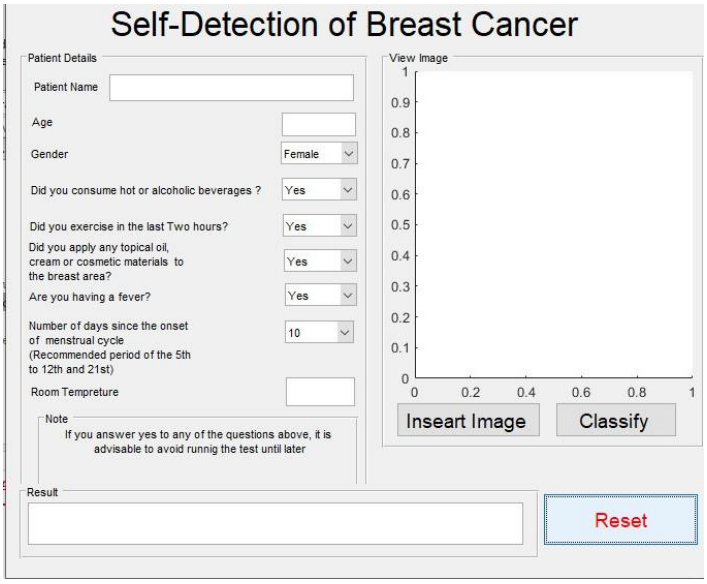

Figure 4. A GUIDE for breast cancer diagnosis from thermal images

4. Cloud Computing

Cloud computing has the ability to process enormous amounts of data at a cheap cost, with excellent performance and limitless storage. As a result, cloud computing is becoming increasingly popular [8]. With addition, in cloud computing, a set of GPUs with high specs can be added. As illustrated in Figure 5, the PC was utilised as a cloud computing platform, with thermal pictures from smartphones being received and analysed on the PC, with the findings being provided to the smartphone via the application.

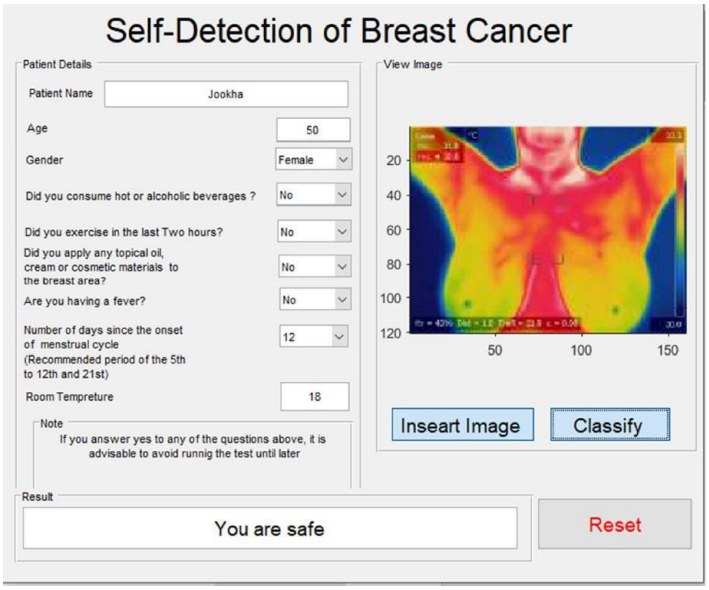

Figure 5. Diagnostic results on the application interface

5. Smartphone Health Application

The term "mobile health" refers to a service that offers healthcare via mobile devices. It has been increasingly popular in recent years as people's interest in public health has grown. Some health applications rely on regular monitoring and are frequently linked to sensors that collect data like heart rate and track the exact position. As a result, these applications provide new digital health service options. Previous research has suggested preventive and recurrence solutions for breast cancer, however no main diagnostic assistance for breast cancer has been mentioned. We developed a function for early detection of breast cancer by combining a thermal camera with smartphone applications, as shown in Figure 6. App is to develop an application that transports data from a smartphone to a cloud computing platform and then delivers the findings back to the smartphone.

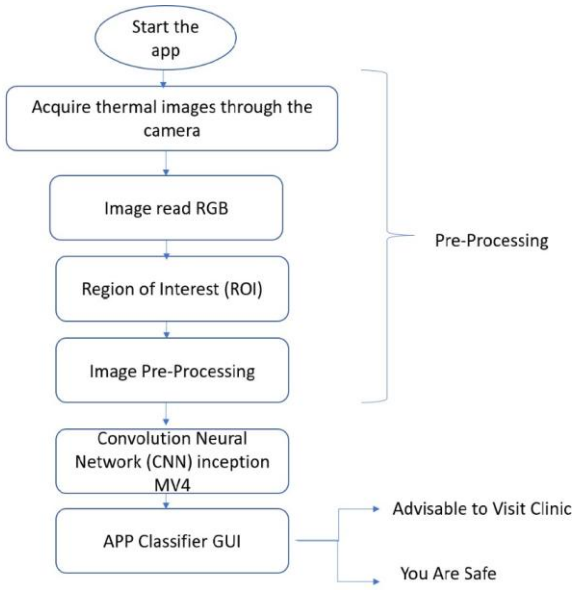

Figure 6. Block diagram of the proposed research.

III. Conclusion

Smartphone health apps have contributed to the rise of the self-care culture. Given prior research aimed at lowering the incidence of breast cancer, a main diagnostic tool that is compatible with health apps on current smartphones is required. With the use of smartphone apps, cloud computing, and thermal cameras, the current research suggests a home-automated diagnostic tool. The proposal's usefulness is confirmed by the experimental findings, which show that breast cancer detection accuracy has reached 100%. We conclude that breast thermography combining smartphone health apps and cloud computing is a good tool for early diagnosis of breast cancer, especially in distant places and for older patients, as well as offering features such as health education, quick response, and periodic follow-up for patients.

This smartphone application tool improves the effectiveness of first self-diagnosis by a factor of ten. Furthermore, this technology is distinguished by its frequent usage at the same time and its application as a family diagnostic tool.

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