SMARTPHONE BASED MELANOMA SKIN AND FALL DETECTION

S.G. Deshpande[1], P.K. Butey[2], V.M. Thakare[3]
[1]Dept. of Comp. Science, Arts, Comm. and Science College, Kiran Nagar, Amravati$_1$
[2]Dept. of Computer Science, Kamla Nehru Mahavidyalaya, Nagpur
[3]P.G. Dept. of Computer Science, S.G.B. Amravati University, Amravati
[1]swapnildeshpande33@gmail.com, [2]buteypradeep@yahoo.co.in, [3]vilthakare@yahoo.co.in

ABSTRACT

The present research work provides a framework and method for fall and melanoma skin detection by using inbuilt smartphone sensors. The result gives an accurate interpretation depending on the data provided to the system.In this paper, the proposed method extracts the signals with the help of a smartphone sensor. This system is a live monitoring system that analyses the human body viz fall and melanoma skin and gives the alarm systematically depending on the critical condition occurs. It also gives the location of the user using the GPS sensor

Keywords: *Global Positioning System (GPS), Mobile Health (Mhealth), Convolutional Neural Networks (CNN)*

1 .Introduction

Nowadays, almost everyone has a smartphone and people have them almost all the time with them. So, smartphones are used to monitor the daily activities of people. In this study, fall detection, as well as melanoma skin disease diagnosis, is recognized from data collected using a mobile phone's sensors. A smartphone has a built-in operating system with more computing capability and connectivity than an ordinary mobile phone. As the popularity of day-to-day life use of smartphone increases, demand for smartphone is also increasing [1].

Applicability of Smartphones for healthcare purposes is that a modern mobile phone is equipped with powerful embedded sensors. Smartphones have the number of sensors attached to it. Mobile phone as a sensor serves to collect process and distribute data around people [2].

Regarding their sensing features, smartphones may be recognized as sensing platforms: they include proximity and light sensors, front and back cameras and microphones, and inertial systems such as accelerometers and gyroscopes and digital compasses [3].

The term Mobile health (m-health) comes from mobile computing and health monitoring. The term mobile computing is used to improve the communication between patients and other health care workers. The term m-health is growing fast recently. Mobile phone improves the quality and availability in healthcare sector and also decrease healthcare services cost [4].

Many health problems arise due to fall such as accidental injuries and deaths to the elderly people who live alone [5]. Fall detection plays important in public health, particularly for elderly people. Elderly people have a higher risk of injury resulting from falls [6].

Skin diseases are very common in rural communities and flood-affected areas [7]. Preferably, skin disease should be treated without delay by a dermatologist. However, due to a shortage of expertise in rural areas, it looks impossible [8]. So there is a need to design and develop an expert system which can timely and correctly diagnose skin disease.

2. Related work

In our world a major health problem is fall and Melanoma cancer. The main aim of the researchers is to find it in early stage in a real world environment. This paper presents

the design of expert system for the detection of melanoma skin diseases.

2.1 Sensors

In this model smartphone, inbuilt sensors are used. In the fall detection module, the embedded acceleration sensor is used for data collection. The other sensor used in this work is GPS equipped with smartphones. In this study, the GPS sensor is chosen to work as the location service provider, as it can provide accurate user information [9].

Sensors available on current smartphones are the conventional sensors such as the cellular radio, WiFi radio, Bluetooth radio, microphone, cameras and GPS, and newer sensors such as the accelerometer, gyroscope, compass, light, temperature, humidity and proximity sensors [10].

2.2 Melanoma skin

According to Dr. Macrene Alexiade, skin cancer is the most common skin disorder. Therefore, this research work mainly focuses on skin cancer disease [11].

Navneet singh et al.[12] diagnose skin diseases using various image processing, artificial neural networks and data mining techniques. For effective skin disease detection image processing techniques with Feature extraction, filtering, image pre-processing, image segmentation techniques are used. It also identifies the color and the form of the infected area.

Nazia Hameed et al. [13] developed an intelligent diagnosis system to classify skin disease into one of five categories, i.e. healthy, acne, eczema, benign, or malignant melanoma using a hybrid approach i.e. using deep convolution neural network and error-correcting output codes (ECOC) support vector machine (SVM). They get accuracy up to 86.21%.

This paper conducts a review of various image processing techniques that are used for diagnosis of skin diseases in recent times. Analysis of the different methodologies and their performances that are used in these techniques of skin disease diagnosis also be done [14].

2.3 Fall Detection

Ren et al [15] detect both falls and fall portents in a tiling operation. Tong *et al.* [16] proposed the hidden Markov model for human fall detection and prediction system using a tri-axial accelerometer.

Waskitho Wibisono et al. [17] developed a smartphone based fall detection application by placing the smartphone at a particular position of user's body, mainly at left chest and detect dynamic situations of posture, followed by unintentional falls to lying postures. They used threshold-based fall detection algorithm because it requires lower computational processes compared to complex reasoning techniques. A set of linear acceleration data and angular velocity is monitored and compare them to a set of thresholds obtained from training data. As soon as they detect fall send an alert message to colleagues in real time.

3. Method

3.1 Convolutional Neural Networks (CNN)

Using various parameters CNN architectures were created, and then proposed a novel CNN model to choose the most appropriate parameter from different architectures.

CNN automatically learn local feature extractors, they are invariant to small translations and distortions in the input pattern, and they implement the principle of weight sharing which highly reduces the number of free parameters and thus increases their generalization capacity compared to NN architectures without this property.

Publicly available online database Dermatology Information System is used for melanoma skin cancer detection [18].

Fig 1. Samples of DermIS dataset 1st and 2nd rows images for melanoma skin cancer, 3rd and 4th rows images for Non Melanoma skin cancer.

3.2 Android

This mobile application can be developed using Android Studio. Android mobile Google Pixel is used to test the software during the designing and development. Java programming language is used for development as an android programming. Sqlite3 is used to store the sensor data on the mobile device [7].

3.3 Participants

Skin infected volunteered and non infected volunteered are considered for skin detection study and Parkinson and normal patients are consider for fall detection. These subjects age ranges from 21 to 60 years. In this experiment, male and female subjects are considered.

3.4 Data collection

The data collection stage extracts raw data from smartphone sensors. The data collection was supervised by doctor to ensure the quality of the data.

With the consent of participants, laboratory tasks are carried out in a light room. Participants were sited in relax position; Skin image was recorded by smartphone camera. At fall detection time participant perform any routine activity with smartphone in his pocket or hand. The recording time was 2 min for each participant.

3.5 Data processing

In real time analysis, accelerometer sensors signal was collected for fall detection.

While in melanoma skin cancer image is preprocessed and compare it with melanoma skin cancer database.

4. Result and discussion

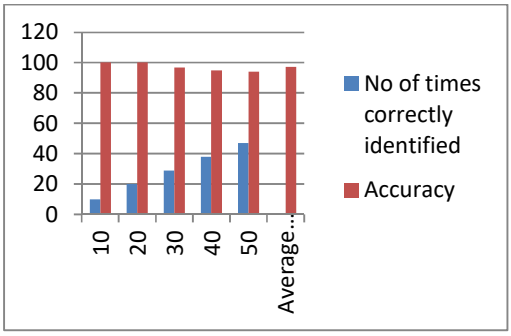
In this framework fall detection is carried out by using a threshold value. Different age group male and female data is compared and tested for accuracy. The result of proposed approach is satisfactory regarding classification accuracy rate.

In this proposed analysis, accuracy was calculated for male and female of the different age group. Following table 1 shows the performance accuracy, when fall occurs while performing different activity.

Table 1: The accuracy of fall detection activity of age group 21 to 60 (male)

Fall Detection Activity		
Age Group 21 To 60 Years (Male)		
No of times tested	**No of times correctly identified**	**Accuracy**
10	10	100
20	20	100
30	29	96.67
40	38	95
50	47	94
Average Final Accuracy of Fall Detection		**97.13**

Fall detection of male with age group of 21 to 60 is reported in table 1 and illustrated in graph 1.



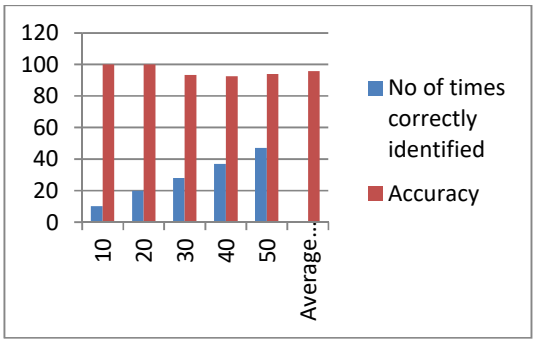
Graph 1: Graphical representation of fall detection at age group 21 to 60 male

From the above analysis, the result shows 97.13% accuracy of male with age group 21 to 60.

Table 2: The accuracy of fall detection activity of age group 21 to 60 (female)

Fall Detection Activity		
Age Group 21 To 60 Years (Female)		
No of times tested	**No of times correctly identified**	**Accuracy**
10	10	100
20	20	100
30	28	93.33
40	37	92.5
50	47	94
Average Final Accuracy of Fall Detection		**95.97**

Fall detection of female with age group of 21 to 60 is reported in table 2 and illustrated in graph 2.



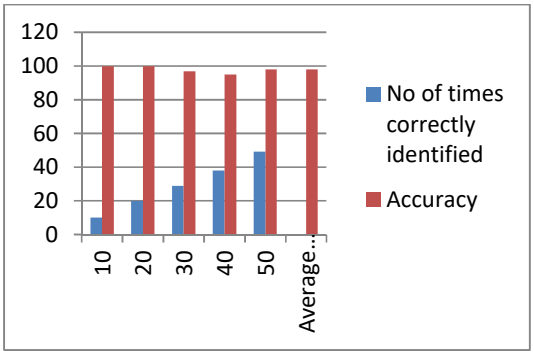
Graph 2: Graphical representation of fall detection at age group 21 to 60 female

From the above analysis, the result shows 95.97% accuracy of female with age group 21 to 60.

Table 3: The accuracy of melanoma skin detection of age group 21 to 60 (male)

Skin Detection Activity		
Age Group 21 To 60 Years (Male)		
No of times tested	**No of times correctly identified**	**Accuracy**
10	10	100
20	20	100
30	29	96.67
40	38	95
50	49	98
Average Final Accuracy of Skin Detection		**97.93**

Melanoma skin detection of male with age group of 21 to 60 is reported in table 3 and illustrated in graph 3



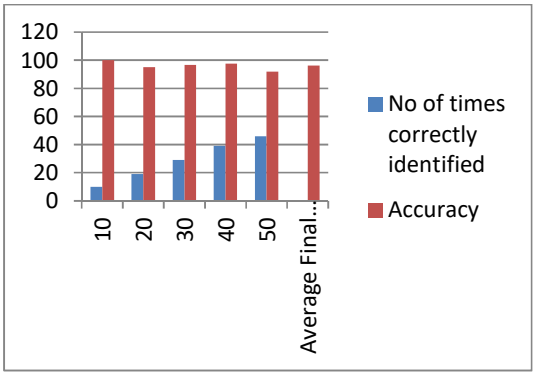
Graph 3: Graphical representation of Skin detection at age group 21 to 60 male

From the above analysis, the result shows 97.93% accuracy of male with age group 21 to 60.

Table 4: The accuracy level of melanoma skin detection of age group 21 to 60 (female)

Skin Detection Activity		
Age Group 21 To 60 Years (Female)		
No of times tested	**No of times correctly identified**	**Accuracy**
10	10	100
20	19	95
30	29	96.67
40	39	97.5
50	46	92
Average Final Accuracy of Skin Detection		**96.23**

Melanoma skin detection of female with age group of 21 to 60 is reported in table 4 and illustrated in graph 4



Graph 4: Graphical representation of Skin detection at age group 21 to 60 female

From the above analysis, the result shows 96.23% accuracy of female with age group 21 to 60.

5. Conclusion

The experimental result shows that, the accuracy of fall detection male while performing activity provides better accuracy than fall detection of female (97.13%).

Similarly, the accuracy of melanoma skin detection of male provides better accuracy than female (97.93%).

This research work can be used as an effective, low-cost solution for fall and skin disease detection. Integrated approach of signal processing with image processing enhances the recognition accuracy.

In future, this study will be carried out for different vital parameters. Also take different diseases for this study.

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