
DermaTrack: A Skin Cancer Tracking Intelligent Application

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Abstract

Although, one in five humans living in high risk areas will develop skin cancer during a lifetime, there is currently no mechanism to help humans track the development of skin moles. DermaTrack, the application described in this paper offers an innovative mechanism, using a mobile application, for i) tracking skin cancer over time, and ii) share the data recorded with a specialized doctor. In this paper, we are providing an evaluation of the prototype mobile application interface developed.

Author Keywords

Usability Evaluation; Interface Evaluation; Mobile Application Evaluation

ACM Classification Keywords

H.5.m. Information interfaces and presentation

Introduction

Skin cancer corresponds to one third of cancer diagnosis but it usually goes undiagnosed [5] or diagnosed at a very late stage¹. This is due to humans usually not noticing the development of skin marks/moles and how these evolve through time [1]. Similarly, when doctors are measuring the moles at

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¹<http://www.cancer.org/cancer/cancercauses/sunanduvexposure/skin-cancer-facts>

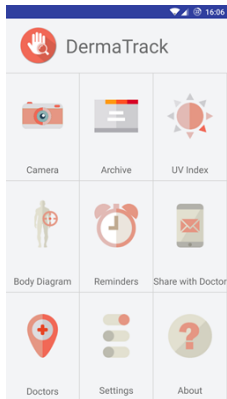


Figure 1 Main screen provides shortcuts to all main functionalities of the application.

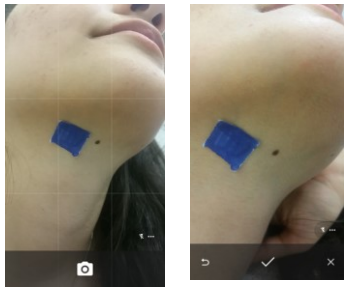


Figure 2 Capturing a photo of a mole next to a reference point (left); the user selects the photo taken (right)

different time points (e.g. once every six months) the inconsistency of measuring tools they are using, along with the possibility of human error [4], lead to unreliable results. Although there are several scientific approaches for medical image analysis and diagnosis of skin cancer e.g [1], currently there are only few mobile applications on the market targeting the patient rather than the professional and provide the functionality of mole tracking (e.g. MySkinPal²) and automatic capturing (e.g. SkinVision³). To the best of our knowledge none of these applications has been implemented to its full potentials, to also provide algorithmic comparison of a mole over time. This paper provides a description and initial usability evaluation of the interface of DermaTrack, developed for providing tracking of a skin mole, analysis of the nature of the mole, comparison of the same mole through time and sharing this information with a dermatologist. Thus, any discussion regarding the algorithm utilized for image analysis and comparison is out of the scope of this paper.

Application Overview

The application is currently developed for Android operating system and apart from the main functionalities, it provides UV index information, Reminders, and Doctor's information. The main functionalities deal with the **Tracking and Analyzing** a mole, **Comparison of images** of moles archived through time and **Sharing** the archived information with a doctor. The main screen of the application provides shortcuts to all functionalities (Figure 1). The

² <https://www.myskinpal.com/>

³ <https://skinvision.com/>

user can touch an icon (shortcut) to navigate to the corresponding function.

Detection and Analysis

One of the main functionalities of the application is to capture and analyze moles through images taken using a mobile phone camera. Figure 2 corresponds to the camera option of the menu. In this screen the user can take a picture of the mole alongside with a reference point (e.g. a sticker). If the user is satisfied with the photo taken, the next step is to crop the mole and the sticker region. For user convenience, guidelines have been added on how to crop the picture.

Firstly, the mole region is being cropped. Then, the user is prompted to crop the sticker region (Figure 3). The sticker and mole need to be cropped, since the sticker dimensions are used by the intelligent algorithm for calculating the dimensions and other comparison information related to the mole.

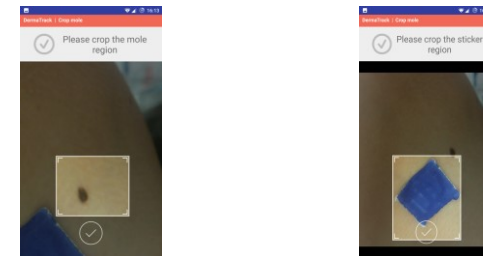


Figure 3 The mole region is cropped (left) and then the sticker region is cropped (right). Instructions are provided to the user.

To keep track of the mole the user is prompted to select the area in a body diagram where the recorded mole appears. The selection can be either onto the front or back of the body (Figure 5).

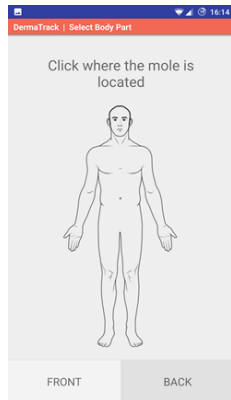


Figure 5 The user has to select the body area where the mole is detected

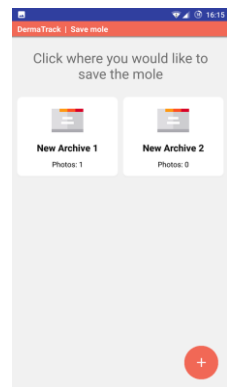


Figure 6 The user is prompted to select where to save the photo captured. It can be an existing Archive or to create a new one using the plus sign in the low right corner

Archiving and Comparison

The next step of the process is to choose where the mole will be saved. A mole can be saved in existing archives or in new ones by clicking the add button in the bottom right corner. We suggest that each mole should have its own archive to enable easier deviation tracking. In this way changes over time will be able to be detected and acted upon. At the end of this process the final screen appears, providing feedback to the user for the task performed and the opportunity to navigate back to the Archives. By clicking on one of the Archives, the user can examine the mole pictures and the metrics associated with them. The listing background will change to either red or green based on the outcome of the analysis. Red indicates high malignancy, green indicates low malignancy.

Morphological information [5] are also provided based on the image analysis performed (Figure 4 -left) By clicking on the mole picture, the listing is expanded and thus, the results returned by the analysis are being displayed. Since evolution in shape metrics is one of

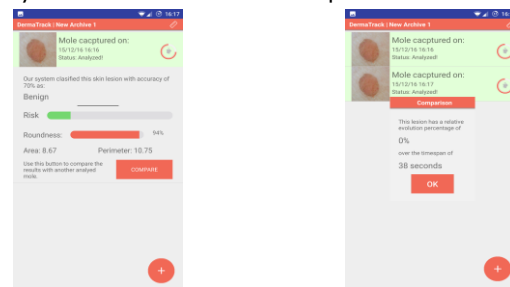


Figure 4 The listing background will change to either red or green based on the outcome of the analysis. Morphological information of the mole are also provided (left). Comparison of the photos captured at different time points is vital (right).

the major symptoms of skin cancer, a user but also a doctor is able to automatically get comparison results from mole images taken in the past (Figure 4 - right).

Sharing

Finally, the user has the option to share the archived images and analysis performed on the application with a specialized doctor. This can be done through the app. The user selects the image to be shared and a share package is created (Figure 7). Then the user provides the information (email address) of the doctor (Figure 8) and then the email application that will be used for the package to be sent. The application then loads and the images are sent to the doctor.

Initial Usability Evaluation

DermaTrack prototype was brought to an initial evaluation with potential users. The purpose of this evaluation was to assess the usability of the prototype and the perception of the potential users for the use of this kind of applications.

11 users took part in this evaluation study. Since this is a prototype and the application concerns a serious medical condition we wanted to initially evaluate it with users who do not suffer from cancer, but appear to have moles that needed attention. We asked each participant to perform a series of tasks that allowed them to utilize all the functionalities of the application in the following order:

1. Take a photo of the mole they would like to track;
2. Crop the part of the photo they want to save;
3. Mark this on the human body diagram;
4. Save the photo on an archive for future reference;
5. If an archive does not exist create one.
6. Do step 4;
7. Share the desired archive with a doctor.

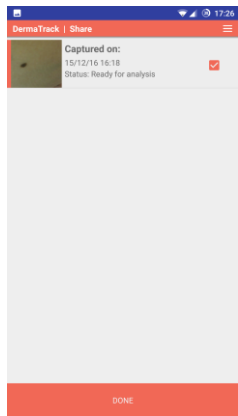


Figure 7 the user selects the image to be shared with the specialised doctor

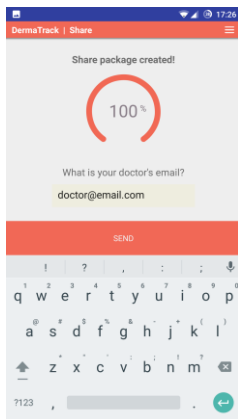


Figure 8 The share package is created and the doctor's email address is provided

Methods & Results

After the completion of the task a questionnaire was administered to the participants. Personal interviews were carried out with selected users for enhancing the results of the questionnaires. The questionnaire comprised of 10 questions coming from the System Usability Scale (SUS) [2] and After Scenario Questionnaire (ASQ) with five questions to examine perception and acceptance.

The results of SUS have been scored and analyzed according to the guidelines provided [2] and a usability score of 81.364 has been achieved. Interpreting this number in terms of the usability, we can conclude that the application achieved an excellent score for usability. Looking deeper into the scores provided by the users we can see that most of the users thought that the application was easy to use (Mean: 4.27, SD: 1.009), the various functions were well integrated (Mean: 4.00, SD: 0.775) and that most of the users would be able to learn how to use the app very quickly (Mean: 4.82, SD: 0.405).

ASQ allowed us to examine users' perception of the task execution and willingness to accept the application. Overall, the users thought that this application would be useful for the patient in keeping track of a suspicious mole rather than used by a doctor (of course this might change if we ask a specialist); they thought that the time required for completing the task was acceptable and the support information provided in each screen were adequate. They reported that the application was slow at times for processing and comparing images. Further to ASQ, selected users were invited for a personal interview. The feedback mainly concerned with the cropping instructions that

needed to be clearer and to direct a first-time user better in the process; and the addition of a 'take a photo' button in the Archive screen, so the user does not have to go back to the main menu to take another photo.

Future Work

The next steps in this work is to evaluate the application with specialized doctors in terms of its scientific validity (accuracy of information provided to the patients) and ethical issues that might arise. For example, could the application shift the responsibility of detecting cancer from the doctor to the patient? Or could the application make users too secure, thus diverting them from regular visits to doctors? In addition, evaluation of the image analysis intelligent algorithm is vital to be done in the immediate future.

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