Name(s)	Project Number
Nikhil Cheerla	**S1402**

Project Title

Accurate Detection of Skin Cancer Using Multi Stage Neural Networks

Abstract

Objectives/Goals

The objective of this project is to provide doctors an automated and accurate method to diagnose skin cancer from dermoscopic skin lesion images. This system must exceed 95% accuracy and must be able to learn from mistakes to improve its accuracy. The entire process must be packaged in an application that is simple to use.

Methods/Materials

This project has four major sections; image segmentation, feature extraction, neural network analysis, and developing desktop/mobile applications. I developed a two-pass image segmentation algorithm to segment the skin lesion from the surrounding skin. I developed techniques to extract a comprehensive suite of fourteen features to describe each lesion. I then trained a 2-stage artificial neural network classifier with these features extracted from a database of skin lesion images. I fundamentally changed the structure of how inputs were fed to the classifier, vastly increasing the performance (see results). Lastly, I created a desktop and a mobile application that allows doctors to use my research in practice. In this project, I used skin lesion images from a University of Chile database. I used MATLAB for image processing and neural network capabilities and a DermLite# DL1 dermatoscope for testing my mobile application.

Results

My segmentation algorithm was able to successfully detect light colored lesions and discard partial lesion images. Theoretical analysis predicted that a #system of experts# hierarchy or a #second opinion# neural network would both be effective ways to improve performance. This was confirmed by the results achieved: average performance of a 1-stage neural network was only 78.6% compared to 96.1% and 96.7% for my proposed 2-stage classifier system. The accuracy of the system stayed above 95% on repeated training and testing. The sensitivity (probability that a tumor would be detected) was on average 96.7%. Experimentation with test subjects confirmed that no prior experience with MATLAB is needed to use the desktop and mobile applications.

Conclusions/Discussion

I was able to meet all the project goals. My system achieved a higher accuracy than targeted, and was able to learn from new data. The automated applications were simple to use. My research would ideally be used by doctors equipped with an IPhone and dermatoscope to get an instant diagnosis. This technology has the potential to revolutionize skin cancer detection and save lives.

Summary Statement

This project is about an automated and self-learning system that accurately diagnoses skin cancer from skin lesion images.

Help Received

My mentor, Ms. Frazier, provided guidance on how to analyze the results and she also proof read my research paper. My dad helped me prepare the project display board.