Name(s)	Project Number
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Project Title

Developing a Novel, Accurate, and Rapid Machine Learning Based Skin Disease Diagnosis Algorithm and Mobile Application

Abstract

Objectives
To design and implement a novel, accurate, and rapid machine learning based classification algorithm, computer vision software, and a mobile application to classify dermoscopy images as benign or malignant in under 30 seconds, with an accuracy of at least 80%. This is the documented average accuracy of dermatologists with varying levels of experience.

Methods
I designed my own algorithms and developed my own software. I constructed the algorithms with Scikit Learn, Keras, Tensorflow, Python and OpenCV. I also developed a cross-platform (iOS and Android) mobile application with Cordova, as well as a cloud service backend with PHP. I trained and tested each of my algorithms with a dataset of 4000 skin lesion images (about two-thirds train, one-third test) that consisted of 2000 malignant and 2000 benign images. The images were taken from the public ISIC archive of dermatoscopic images.

Results
My system successfully achieved my engineering goals and design constraints, taking on average 22.47 seconds to classify an image when tested with 1320 images that were not used in training. At the 2.5% significance level, my algorithm s accuracy (93%), sensitivity (88%), and specificity (98%) outperformed the corresponding data published from dermatologists with all levels of experience.

Conclusions
This year in the US alone, 96,480 adults are estimated to be diagnosed with melanoma, and 7230 are expected to be fatal. Early detection of melanoma saves lives. It has been reported that up to 70% of melanomas were first discovered by patients and brought to the attention of dermatologists for evaluation. This project demonstrates that the diagnosing effectiveness for melanoma using novel computer vision and machine learning techniques is higher than that of data published from dermatologists with varying levels of experience. My frugal mobile innovation can assist patients with a decision on seeking further professional evaluation.

Next Steps: When possible, dermatologists also factor in family history and a comparison of changes to the lesion over time to make their decision to biopsy. To further improve the accuracy of computer assisted diagnosis, expanding the algorithms to factor in the temporal changes of a lesion can be explored.

Summary Statement

I developed and demonstrated a machine learning based frugal solution delivered as a mobile application that diagnoses melanoma with a higher accuracy, sensitivity, and specificity than dermatologists with varying levels of experience.

Help Received

I designed and programmed the algorithm and mobile application myself using my prior experience with computer vision and machine learning. I reviewed my project with a dermatologist and my mentor (high school science teacher).