Risk Analysis of Skin Cancer using Deep Learning

[An Online system to augment clinician's decision making] *

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ABSTRACT

Skin cancer is the most common form of cancer, accounting for 40% of cases globally. More than 8,500 people in the US are diagnosed with skin cancer everyday. Melanoma rates in the United States have doubled from 1982 to 2011. The survival rate of people with it depends on when they start treatment. The cure rate is very high with early prognosis. The curability is as high as 92% if the cancer is detected early. [7] The prognosis is less favorable if it has spread to other parts of the body. Deep convolutional neural networks have led to new breakthroughs in image classification. Advancement in neural network frameworks and GPU based computing has allowed us to train deeper and deeper networks. We aim to exploit these advancements and apply it to the problem of early skin cancer detection. We achieve an overall accuracy of 90% for the binary classification of malignant and benign skin lesions and an accuracy of 40% for multi-class cancer type classification.

Keywords

Deep Learning; Neural Networks; Skin-cancer classification

1. INTRODUCTION

After the onset of a lesion patients wait several months for an appointment with the doctor since these are usually in the form of mild moles. Dermatologists usually have no way to follow the lesions of their patients over time outside their clinic.

In this paper we describe, https://dermfollow.me/, a system we built to alleviate this problem. Patients can use smartphones to upload pictures of their lesions on the website; say, every week. The system uses the knowledge learnt from several thousand images using deep neural networks to calculate the risk score for the uploaded image and present the most likely cases and high risk patients before the clinician. We also present the similar images to explain why the neural network considers an image as a high risk case. The clinician can use this added information and schedule a speedy appointment with these patients on a priority basis.

2. RELATED WORK

It is only recently that neural networks have been used for the problem of skin cancer classification. Much of the earlier work focussed on extracting features based on image processing techniques to do the classification. In [5], Lee and Chen use low level feature comparison for detecting different cancer types. In [4], the authors use a combination of neural networks and sophisticated image processing and feature extraction techniques to achieve a fast and reliable diagnosis. They were able to obtain a 90% correct classification of malignant and benign skin lesions from the DANAOS data collection. In [6] the authors use a multilayer perceptron to classify melanoma.

There have also been techniques like [3], [8] which combine spectroscopy data with neural networks. These techniques are only plausible in a lab setting with appropriate instruments. The novelty of our technique is that it relies solely on image data. These images can be captured by an individual using smartphones and does not require any specialized pathology skills. The user could get a reminder to upload the image to the website on a periodic basis and the dermatologist could monitor high risk patients easily using our system.

The most recent work which is related to our current work was done by Andre, Kuprel and Sebastian Thrun at Stanford. [2]. The approach used by them is an ensemble of 5 models (VGG16-1, VGG16-2, VGG16-3, VGG19-1, and

*Work done as part cs-6242 class at Georgia Tech

†Matt's inspiration is his father who was diagnosed with melanoma in 2015

DOI: 10.475/123_4

VGG19-2) that classify among the 23 classes. We try to achieve a better accuracy over their model and also build a system for dermatologists to efficiently manage their patients.

3. APPROACH

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3.1 Datasets

You may want to display math equations in three distinct styles: inline, numbered or non-numbered display. Each of the three are discussed in the next sections.

3.1.1 Tensorflow

A formula that appears in the running text is called an inline or in-text formula. It is produced by the **math** environment, which can be We use tensorflow [1]

4. DESIGN

Mention about salient features and the design choices you made

4.1 Architecture

the overall architecture of the website

5. EXPERIMENT AND RESULTS

asdsd

6. CONCLUSIONS

This paragraph will end the body of this sample document. Remember that you might still have Acknowledgments or Appendices; brief samples of these follow. There is still the Bibliography to deal with; and we will make a disclaimer about that here: with the exception of the reference to the LaTeX book, the citations in this paper are to articles which have nothing to do with the present subject and are used as examples only.

7. ACKNOWLEDGMENTS

This section is optional; it is a location for you to acknowledge grants, funding, editing assistance and what have you. In the present case, for example, the authors would like to thank Gerald Murray of ACM for his help in codifying this *Author's Guide* and the **.cls** and **.tex** files that it describes.

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