

# A Critical Analysis of Computer Aided Approaches for Skin Cancer Screening

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**Abstract**—Skin Cancer is life-threatening when diagnosed at a later stage. Early detection of skin cancers such as melanoma indicates a higher survival rate for the patient. Non-computer aided tools were used in the past such as the visual inspection using tools like the dermoscopy. Commercial tools were later introduced that allowed the examiners to examine the images obtained from the dermoscopy using techniques such as the ABCD rule and 7-point checklist. Deep Learning has proven to be the state-of-the-art for computer vision problems such as image classification. A lot of research has been carried out in the application of deep learning for automating skin cancer screening. This paper presents an analysis of the existing work carried out in the area of automatic skin cancer screening and the different steps involved in building a skin cancer classification tool for skin cancer screening. The limitations of the various existing approaches are explored, and the results of the analysis will be used as part of an ongoing research to design and develop a robust system that will address the identified cons.

**Keywords**—Skin Cancer, Screening, Computer Vision, Deep Learning, Augmentation, Segmentation, CNN

## I. INTRODUCTION

Cancer is a health hazard and is considered to be one of the deadliest diseases in the world. The mortality rate for cancer is high compared to that of other diseases [1]. Skin Cancer, a form of cancer, can be cured if diagnosed early but becomes lethal if not diagnosed early and allowed to grow [1]. According to World Health Organization (WHO), there is an increase in the number of skin cancer cases over the past decade [2]. In countries such as the United Kingdom and Brazil, the number of skin cancer cases have increased by 2-fold in just the past decade [3][4]. Countries such as the United States of America are experiencing a shortage in the number of experienced dermatologists [5][6]. A study carried out in Sri Lanka at the National Hospital of Sri Lanka (NHSL), shows that out of the 123 respondents that are doctors only 10 had received formal training on how to perform full body examination and out of the 13 doctors that had performed full body examinations, only 2 had carried out more than five examinations in the preceding 12 months [7]. This shortage of well-trained dermatologists calls for an automated skin screening tool that can aid dermatologists in the screening process.

## II. PROBLEM & MOTIVATION

Unaided visual inspection was used for the screening of patients before the invention of dermoscopy. This approach only had an accuracy of about 60% [8]. The diagnostic accuracy among dermatologists with training under 5 years is very low but the accuracy is higher for those who have an experience of over 10 years [9]. Several clinicians have failed to adopt the algorithms that were developed to improve

scalability in favor of experience. Tools were later developed to assist dermatologists in the screening of patients for skin cancer. Dermoscopy, as mentioned earlier, is one such popular tool that was adopted by dermatologists around the world.

Dermoscopy is a widely used non-invasive medical imaging technique that is used for skin cancer screening and early detection of skin cancer. The tool uses a microscope and incident light to visualize the subsurface features of the skin providing a dermoscopic image of the skin [8][9][10]. The dermoscopy shows a significant improvement in terms of accuracy when compared to that of unaided visual inspection. The accuracy increases from around 60% to 90% when used by a well-experienced dermatologist [8][9][10]. As mentioned earlier, the accuracy is subjective and high depends on the expertise of the dermatologist. The accuracy is no better than that of unaided visual inspection when the tool is used by a non-experienced practitioner [9][11]. The understanding of techniques such as ABCD rule, Menzies scoring method and 7-point checklist is also a requirement to use dermoscopy as such techniques are used to analyse the images obtained from the dermoscopy [11]. A study suggests the involvement of two or more experienced dermatologists when carrying out the skin examination for better accuracy [10]. But with the shortage of well trained and experienced dermatologists, this is a major issue. In such scenarios, an automated skin screening tool can aid dermatologists in the screening process allowing them to screen many patients accurately in a short period of time. The number of misdiagnoses can also be reduced by utilizing such an approach.

## III. EXISTING WORK

Several researches have been carried out in the application of Machine Learning for the classification of cancer diseases. This successfully automates the skin screening process. Most of these approaches have utilized dermoscopic images for the training process.

The use of a machine learning approach involves several steps as part of the classification process. This review also analyses the different approaches that have been explored for each of these steps involved in constructing an automated skin screening tool while also identifying the main limitations faced during these researches.

The initial step carried out is data gathering where data related to the problem being solved needs to be gathered. Here, skin cancer related datasets need to be collected in order to carry out the classification. The next step would be to pre-process and prepare the images. In case of dataset imbalances and lack of data, data augmentation can be carried out which can drastically improve the classification accuracy as well.