A TECHNICAL ANALYSIS OF SKIN CANCER CLASSIFICATION TECHNIQUES WITH MACHINE LEARNING ALGORITHMS

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Abstract. *Skin cancer is among the most common cancers. It is constantly rising. Melanoma had been highly lethal cancer among all skin cancer diseases. Melanoma is the cancer with the strongest mortality rate. If caught early enough, it can be healed. Melanoma will claim the lives of 6850 people in 2021. Computational approaches have been shown to be a vital part in the early diagnosis of this fatal disease. Due to low contrast and a significant degree of visual resemblance, discriminating between melanoma and nonmalignant lesions is difficult. A non-invasive technology known as computer aided diagnosis (CAD) has been shown to develop premature and quicker detection of malignant cancer. There are four steps to CAD: Pre-processing, dependable, segmentation, appropriate feature extraction, and an precise classifier. The focus of this research is on current machine learning algorithms for melanoma detection using clinical images. This study also includes statistics and findings from a comparison of classification methods' performance with other machine learning.*

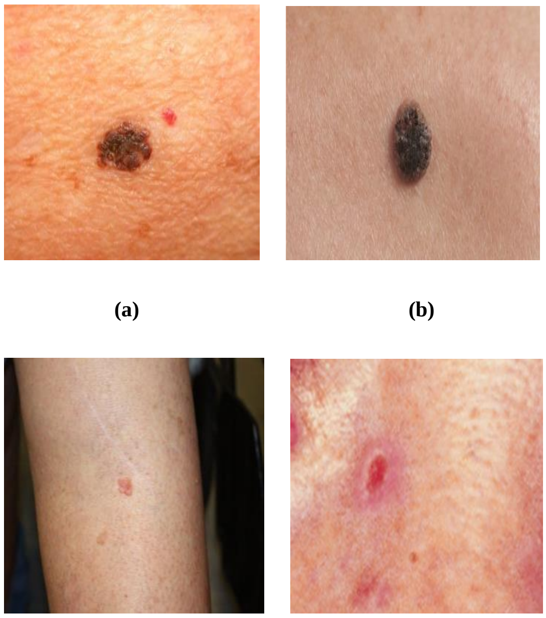
***Keywords**: skin cancer, melanoma, database, feature extraction, classification*

1. INTRODUCTION

The biggest area of the human body covered by skin is approximately 20 square feet [1]. The key function of our skin is to regulate body temperature and protect interior organs from UV radiation. It too contributes to the sensations of cold, warmth, and touch. Human skin has three layers: i) the epidermis, ii) the dermis, and iii) the hypodermis.

Destructed cells appear when aberrant skin cells develop out of control. Tumours are caused by abnormal growth, which results in malformations of skin cells. Skin cancer develops from these tumours. The UV rays of the sun are primarily responsible for skin cancer. Skin cancer lesions are classified as benign or malignant.

Malignant skin cancer is deadly, whereas benign mole development is non-cancerous. Squamous cell carcinoma (SCC) and Bessel cell carcinoma (BCC) are two types of skin cancer that are both innocuous and do not spread from one place of the body to another [2]. Melanoma is caused by melanocytic cells in the skin, and it can enter in to other parts of the body [3]. Different types of skin tumours are depicted in Fig. 1. Melanoma cases are rapidly growing, according to the National Cancer Institute's records [4]. It is the most often diagnosed malignancy and the third most common cause of death [5]. Melanoma kills one person every hour, according to the report [4].



(a) **(b)**

(c) **(d)**

Source: Realized by authors

Fig. 1 (a) Early stage Melanoma (b) Melanoma (c) SCC and (d) BCC

The rate of growth of skin cancer has accelerated in recent years, posing a direct threat to people's lives [6].

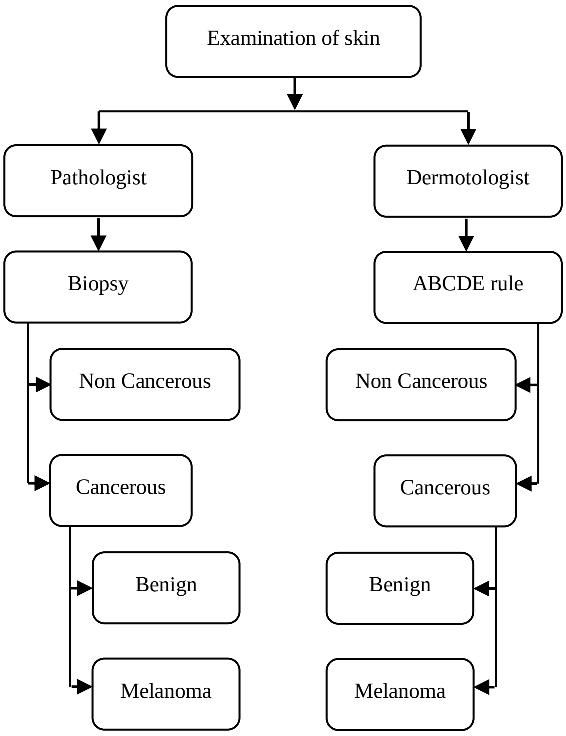
Melanoma has the highest prevalence in Australia's population. Females have a higher survival rate than men in many countries, according to the data [7].

2.1. DATABASE

Dermoscopy is a non-invasive method for diagnosing melanoma. Skin cancer is frequently detected with dermoscopic pictures. These images offer a lot of promise for melanoma early detection. These images are utilised in diagnostic tool preparation, education, and research. Table 1 illustrates different types of dataset used for melanoma detection [2].

2.2. CLINICAL AND DERMOSCOPIC MEANS OF MELANOMA DIAGNOSIS

The skin is examined by a clinician using clinical methods. Initially, the doctor examines the skin for changes such as moles, colour, or shape. It is then referred to a pathologist or dermatologist to confirm if it is cancer or not. Biopsy is an invasive method used by pathologists. Skin tissues are sliced for inspection during a biopsy. In the twenty century, dermoscopy was introduced to defeat biopsy and progress cancer detection. Dermoscope was used to obtain these images, which have a good magnification and clarity. Diagnosis system is made with computer assistance. The steps involved in traditional clinical techniques is depicted in Fig. 2 [4].



Source: Realized by authors

Fig. 2 Cancer diagnosis clinical methods

Table 1 Lists all datasets that are publicly available

No.	Name of dataset	Number of images
1.	ISIC	24000
2.	HAM10000	10000
3.	MED-NODE	170
4.	DermIS	6800
5.	Dermatology Atlas	11000
6.	Danderm	1900
7.	Dermnet	23000
8.	DermnetNZ	20000
9.	Dermatoweb	7300
10.	Dermofit	1300
11.	PH2	200
12.	Interactive Dermatology Atlas	1000
13.	Atlas of Clinical Dermatology	3000

Source: Realized by authors

3. COMPUTER AIDED DIAGNOSIS (CAD)

Skin cancer diagnosis using a computer is a popular way these days. It is significantly more accurate than the procedure used by dermatologists. The CAD system provides a method for locating lesions and also assesses disease likelihood [8]. The key phases in computer-aided diagnosis of clinical photographs are depicted in Fig. 3 [2].

The origin of dermatoscopy belongs to the mid-17th century, after the discovery of Pierre Borel (Borrelius Petrus), considered its founder, followed by the names and important contributions of Johan Christophorus Kolhaus, Ernst Karl Abbe, Unna, Muller, Saphier and many others. While a lot of terms have been used to reveal and describe the process of dermoscopy, from dermatoscopy, surface microscopy, incident light microscopy, or even epiluminescence light microscopy, dermoscopy remains the usual conceptualization for non-invasive method, facilitating all the examination of the skin and evaluating pigmented skin lesions.

The first dermatoscope was invented by an entire team of doctors led by Professor Otto Braun-Falco with the support of the medical device manufacturer HEINE Optotechnik. That first dermatoscope was hand-held and illuminated by a halogen lamp, and was the father of modern dermatoscope used to obtain the up-to-date images, which have indeed a very good magnification and clarity. Menzies Method, ABCDE rule, 7-point checklist etc. are used to identify cancer using dermoscopy images. Dermoscopic methods have a lot of potential for accurately diagnosing cancer.

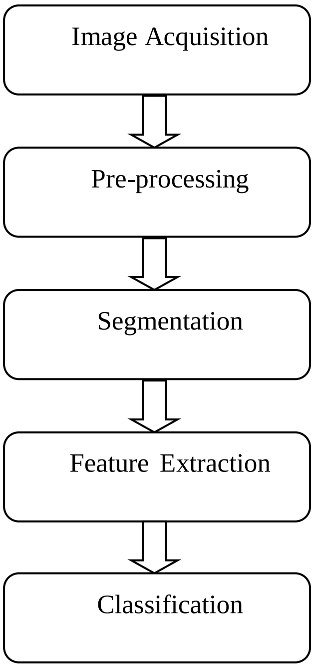


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Fig. 3 The process of using a CAD system

4. CLASSIFICATION OF LESIONS

Lesion classification is critical in computer-assisted diagnosis. The purpose of the classification stage is to distinguish between malignant and healthy lesions based on the features retrieved. A feature vector is created for each lesion. The data is separated into two sets for classification: training and testing. The classification model is created in the training phase with a arbitrarily chosen dataset and then verified with the remaining of the dataset for parameters like specificity, accuracy, sensitivity etc..

Different machine learning algorithms for classification are investigated in this research. Table 2 lists the many machine learning techniques for melanoma classification that have been published. According to the literature the percentage use of different classification techniques are displayed in Fig. 4.

Table 2. Lists all datasets that are publicly available

No.	Machine learning techniques for classification	References
1.	Decision Tree	[9], [20], [37], [38], [39], [40], [41], [62]
2.	KNN	[10], [21], [22], [23], [42], [43], [57]
3.	Logistic Regression	[11], [24]
4.	Discriminant Analysis	[12], [26], [27], [28],
5.	Bayesian network	[13], [29], [44], [45]
6.	ANN	[14], [30], [31], [32], [33], [46], [47], [48], [49], [50], [56], [58], [59]
7.	SVM	[15], [25], [34], [35], [36], [51], [52], [53], [54], [55], [60], [61]
8.	Fuzzy Logic	[16], [19], [63]
9.	Ensemble of classifiers	[17], [18], [62]

Source: Realized by authors

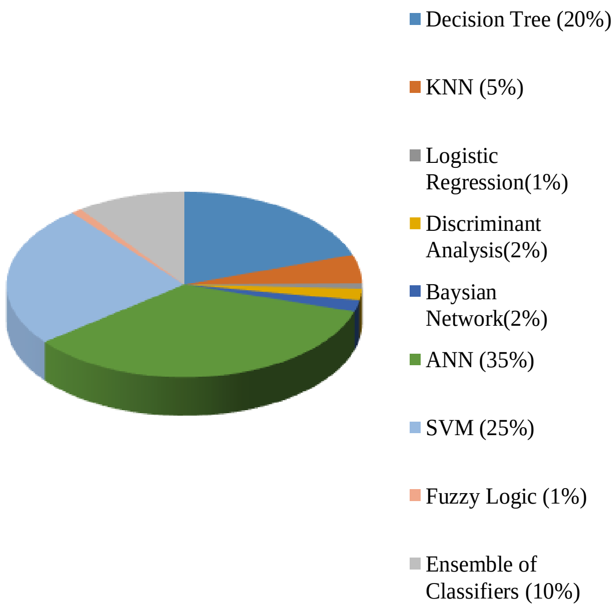

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Fig. 4 Distribution of skin cancer detection categorization techniques in the literature

5. CONCLUSIONS

The Early detection of melanoma is an important research subject. The current strategies for ML-based skin cancer detection are presented in this article. This study also demonstrates that in the field of ML for Melanoma Detection, ANN is the most extensively utilised and accurate technique. This survey specifies categorization strategies that are specifically automated. A comparison study is presented for each and every method of classification. This study, in conclusion, emphases on accurate computational detection to assist dermatologists. This research can help to fill in the breaches in the literature and improve the enactment of present techniques. Furthermore, these techniques may mask a variety of issues with skin lesion classification, transforming ML Algorithms into more precise systems for identifying malignant lesions using clinical images.

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