# Chapter 68
# Useful Features for Computer-Aided Diagnosis Systems for Melanoma Detection Using Dermoscopic Images

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## ABSTRACT

*The development of performing imaging techniques is favoring the spread of artificial vision systems as support tools for the early diagnosis of skin cancers. Epiluminescence microscopy (ELM) is currently the most adopted technique through which it is possible to obtain very detailed images of skin lesions. Over time, melanoma spreads quickly, invading the body's organs through the blood vessels: an early recognition is essential to ensure decisive intervention. There are many machine learning approaches proposed to implement artificial vision systems operating on datasets made up of dermatoscopic images obtained using ELM technique. These proposals are characterized by the use of various specific features that make understanding difficult: the problem of defining a set of features that can allows good classification performance arises. The aim of this work is to identify reference features that can be used by new researchers as a starting point for new proposals.*

## INTRODUCTION

The analysis of images for dermatoscopy (DIA) is a very active area of research. The abundance of publications is likely to confuse new researchers who have objective difficulties in identifying new directions to explore.

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Skin cancer is related to an abnormal development of skin cells and arises when DNA induces a change in skin cells or hereditary deformities. One of the main reasons for the onset of skin cancer are the ultraviolet (UV) radiation of both UVA and UVB sunlight. Melanoma is a particularly aggressive form of skin cancer, which can easily spread from one part of the body to another.

Practically, the doctor who examines the patient's skin takes the first step in diagnosing melanoma. If the specialist notices some significant variation in the size, color, shape and texture of the mole, the patient is referred to as pathologist or dermatologist, which by biopsy confirms or not the presence of skin cancer. Biopsy is a clinical method that involves the excision of portions of skin tissues subsequently used to diagnose skin cancer. The biopsy is invasive and involves up to 12 weeks of awaiting for the results.

Dermatoscopy or epiluminescence microscopy (ELM) is an increasingly used technique for detecting skin cancer because it allows the analysis of enlarged images (usually $\times$ 20) being also a non-invasive skin imaging technique. Dermatologists acquire the image of the affected skin through a particular tool called dermatoscopy, and discriminate the nature of the skin lesion, applying clinical protocols such as the ABCDE rules (AAD 2019) (Asymmetry, Border, Color, Diameter and Evolution), 7-point checklist (Argenziano et al., 1998), CASH (Color, Architecture, Symmetry and Homogeneity) (Henning et al., 2007) and the Menzies method (Menzies et al., 1996).

The medical scientific community looks with increasing interest to artificial vision systems for the classification of skin lesions. Early diagnosis and removal become essential when the tumor is in the early stages. This justifies the common interest in providing solutions that support early and accurate diagnosis, facilitating both the work of specialists and effective self-diagnosis through mobile applications.

The diagnosis of melanoma through automated analyzes is not yet reliable and the diagnostic accuracy still depends on the experience of dermatologists: the current interest is directed towards a solution capable of offering a second opinion to the specialist.

The World Health Organization reports that in 2018 more than 60.000 persons died due to melanoma and the new cases are over 28.0000 (International Agency for Research on Cancer, 2019). Melanoma is affecting both male and female populations of the whole world, and in particular that of North America, Australia and Europe (Figure 1).

If on one hand the cutaneous melanoma is fearful for its aggressiveness and for its ability to spread quickly to other organs, on the other hand when it is diagnosed in the initial stages it can be simply managed. Unfortunately, however, in the early stages melanoma appears similar to other benign lesions. These assumptions amplify the need to create automatic systems capable of supporting the diagnosis of melanoma from the initial stage. In general, these solutions provide a series of steps including: image acquisition, image pre-processing, segmentation, features extraction and finally classification.

Among the different phases of a CAD system, the most relevant is that of features extraction. The aim of this work is to identify reference features that can be used as a starting point for new proposals.

In Section II, to help the reader understand visual differentiation, the optical properties of skin layers are addressed. In Section III, referring to the literature, the general aspects of image acquisition, pre-processing and segmentation are introduced while in Section IV an overview on useful features that can be taken in considerations by new researchers as profitable starting set on dermoscopic images is reported. Finally, some conclusions are drawn.