Chapter 12
Melanocytic Lesions Screening through Particle Swarm Optimization

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ABSTRACT

Early detection of malignant melanoma, which is the most dangerous skin cancer, significantly improves the chances of curing it. For this reason, dermatologists are looking for new methods for the examination of suspicious lesions that changes their shape over time. The author investigates in this chapter some algorithms which may be used for automated diagnosis of skin lesions. First algorithm performs the image segmentation by edge detection, which plays an important role in identifying borders of the lesion. Next algorithm uses the Particle Swarm Optimization (PSO) paradigm for recognizing the images of the same melanocytic nevus taken at different moments of time. The idea is that a novel view of an object can be recognized by simply matching it to combinations of known views of the same object. The main difficulty in implementing this idea is determining the parameters of the combination of views. The space of parameters is very large and we propose a PSO approach to search this space efficiently. The effectiveness of this approach is shown on a set of real images captured with a camera under different angles of view.

INTRODUCTION

Detection and early diagnosis of skin cancer remains the main concern of dermatologists worldwide. Malignant melanoma is now one of the most common forms of cancer among world's population, especially in fair-skinned individuals. Change of recreational behavior together with the increase in ultraviolet radiation cause a dramatic increase in the number of melanomas diagnosed. The curability of this type of skin cancer (about 70%) depends of early enough recognition and surgically treatment. Many publications report on isolated efforts into the direction of automated

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melanoma recognition by image processing, but complete integrated dermatological image analysis systems are hardly found in clinical use (Gauster et al., 2001).

Małaczewska and Dabkowski (2004) talk about the contemporary view on the melanocytic nevi and their role in the pathogenesis of skin malignant melanoma. There is a strong relationship between the presence of the melanocytic nevi and the incidence of melanoma. For that reason dermatologists should pay close attention to patients from the risk group, with many common and atypical melanocytic nevi, family history of melanoma, bright fair skin, with history of sun burns. These patients should be meticulously and regularly checked up. Examination should include photographic surveillance and dermatoscopy and every suspected mole should be excised with further histological examination. This kind of procedure intensifies the possibility of early recognition of melanoma malignum of the skin, which is crucial for successful treatment of this dangerous disease.

Clinical features of melanoma are summarized as what's called ABCD rule, promoted by the America Cancer Society: A (Asymmetry), B (Border irregularity), C (Color variegation) and D (Diameter greater than 6mm). Early recognition of changes of lesion in terms of the previous features provides important diagnostic and prognostic information. Other screening guidelines are established by the seven-point checklist, advocated by a group of dermatologists from Glasgow. This checklist emphasizes the progression of the symptoms and consists of three major features (change in size, shape and color) and four minor features (inflammation, crusting or bleeding, sensory change, and diameter greater than 7mm). When any of the major features is detected in a melanocytic lesion, immediate help from health professionals is recommended. The presence of any minor features is advised to be monitored regularly (Lee, 2001; Liu et al., 2011). Schleicher et al. (2003) attached two more letters to the ABCD rule: E (Elevation) and I (Itch). Over time, most melanomas will become raised, and a very early signal that a mole is becoming cancerous is the sensation of itching at the site of the lesion.

Patients with large congenital melanocytic nevi are at increased risk for developing various medical problems, including cutaneous melanoma. In general, most studies reporting on the risk of melanoma in large congenital melanocytic nevi enrolled patients with lesions that were at least 20 cm in diameter, but there are no evidences between the risk and the absolute size of the lesion or its clinical appearance (flat, raised, rugous, speckled, etc). However, some recent data suggest that the risk for melanoma may be highest for lesions greater than 40 cm, located on the torso rather than on the head, neck or extremities (Slutsky et al., 2010). The method described in this chapter may be used also for this kind of lesions.

As a melanocytic lesion ages, both the skin where it is settled as well the nevi cells themselves, undergo alterations in their structure. An estimated percentage of 20 or 30 of lesions disappear in old age. This process of involution and disappearance is hard to prove in individual lesions, but there are proven cases based on old photographs where this had happened (Cintra et al., 1994). So, it's a good idea to follow the evolution of these lesions in time using photographs taken at different moments of time and different angles of view.

At this time dermatologists prefer to examine the suspect moles with the dermatoscope. Dermatoscopy significantly improves the sensitivity for melanoma detection compared to the naked-eye examination. Using dermatoscopy, melanoma may be detected before it displays the classical clinical features summarized in the ABCD rule. Dermatoscopy allows the detection of early melanoma-specific criteria that are visible under the dermatoscope even when the size of the tumor is less than 6mm, leading to a diagnosis at an earlier stage, when melanoma looks like a benign lesion. According with Moscarella et al. (2010), dermatoscopy has to be considered as