

Preface

Malignant melanoma is one of the most rapidly increasing cancers in the world. Invasive melanoma alone has an estimated incidence of 76,690 and an estimated total of 9,480 deaths in the United States in 2013 [1]. Early diagnosis is particularly important since melanoma can be cured with a simple excision if detected early.

In the past, the primary form of diagnosis for melanoma has been unaided clinical examination. In recent years, dermoscopy has proved valuable in visualizing the morphological structures in pigmented lesions. However, it has also been shown that dermoscopy is difficult to learn and subjective. Newer technologies such as infrared imaging, multispectral imaging, and confocal microscopy, have recently come to the forefront in providing greater diagnostic accuracy. These imaging technologies can serve as an adjunct to physicians and provide automated skin cancer screening. Although computerized techniques cannot as yet provide a definitive diagnosis, they can be used to improve biopsy decision making as well as early melanoma detection, especially for patients with multiple atypical nevi.

The goal of this volume is to summarize the state of the art in the utilization of computer vision techniques in the diagnosis of skin cancer and provide future directions for this exciting subfield of medical image analysis. The intended audience includes researchers and practicing clinicians, who are increasingly using digital analytic tools.

The volume opens with six chapters on dermoscopy images. In “[Pigment Network Detection and Analysis](#),” Sadeghi et al. describe a novel graph-based method to extract pigment networks from dermoscopy images. Laplacian of Gaussian edge detection output is converted to a graph from which cyclic subgraphs that correspond to skin texture structures are extracted. Subgraphs for round structures such as globules, dots, and bubbles are eliminated based on their size and color. Another higher-level graph is then created from the remaining subgraphs, where each node represents a hole in the pigment network. Finally, the image is classified according to the density ratio of this graph using the LogitBoost classifier. The authors obtain promising results on a set of 436 dermoscopy images.

In “[Pattern Analysis in Dermoscopic Images](#),” Sáez et al. propose a model-based approach for the classification of dermoscopy images based on five global patterns (reticular, globular, cobblestone, homogeneous, and parallel) defined in the commonly used Pattern Analysis scheme. The color information in the images

is represented in a three-channel color space such as RGB, YIQ, HSV, and $L^*a^*b^*$. Each of these channels is then modeled as a Markov Random Field following a Finite Symmetric Conditional Model. Coupling among color channels is taken into account by assuming that the model features follow a multivariate normal distribution. The authors obtain promising results on a set of 100 dermoscopy images.

In “[A Bag-of-Features Approach for the Classification of Melanomas in Dermoscopy Images: The Role of Color and Texture Descriptors](#),” Barata et al. investigate the applicability of the bag-of-features (BOF) paradigm based on color and texture features to the classification of dermoscopy images. Based on experiments on a set of 176 dermoscopy images, the authors conclude that the BOF paradigm provides an accurate representation of dermoscopy images and that the color descriptors outperform texture descriptors with respect to classification accuracy.

In “[Automatic Diagnosis of Melanoma Based on the 7-Point Checklist](#),” Fabbrocini et al. present a fully automated computer-aided diagnosis system for melanoma based on the 7-point checklist. The system involves border detection using thresholding, extraction of various low- and high-level dermoscopic features, and classification using logistic model trees.

In “[Dermoscopy Image Processing for Chinese](#),” Xie et al. elaborate on a computer-aided diagnosis system for melanoma specifically designed for Chinese patients. The system involves hair removal using partial differential equation-based inpainting, border detection using self-generating neural networks combined with genetic algorithms, extraction of various shape, color, and texture features, and classification using a neural network ensemble. The authors obtain promising results on a set of 70 dermoscopy images.

The final dermoscopy chapter, “[Automated Detection of Melanoma in Dermoscopic Images](#)” by Arroyo and Zapirain, describes a computer-aided diagnosis system for melanoma based on the ABCD rule of dermoscopy. The system involves removal of artifacts such as black frames, hairs, and bubbles, border detection using thresholding, extraction of various low- and high-level dermoscopic features, and classification using decision trees.

The volume continues with four chapters on clinical (macroscopic) images. In “[Melanoma Decision Support Using Lighting-Corrected Intuitive Feature Models](#),” Amelard et al. propose a framework that performs illumination correction and feature extraction on photographs of lesions acquired using standard consumer-grade cameras. They also discuss how these lighting-corrected intuitive feature models can be used to classify skin lesions with high accuracy.

In “[Texture Information in Melanocytic Skin Lesion Analysis Based on Standard Camera Images](#),” Cavalcanti and Scharcanski describe five representative sets of visual features commonly used for the representation of texture information in melanocytic lesions, and analyze how these features distinguish between malignant and benign lesions using popular classifiers.

In “[Recovering Skin Reflectance and Geometry for Diagnosis of Melanoma](#),” Sun presents a method for estimating and using the skin reflectance recovered as a

replacement for conventional photographs in the evaluation of the ABCD criteria. They also discuss how to use the geometry of a lesion's surface to characterize the topography disruption within the lesion. In order to demonstrate the effectiveness of their approach, the authors compare features derived from reflectance and geometrical information with two-dimensional skin line patterns.

A chapter on classification entitled “[Melanoma Diagnosis with Multiple Decision Trees](#)” by Zhou and Song completes the volume. The authors discuss the decision tree model as a mechanism that mimics the clinical diagnostic rules. They also compare the performance of various decision trees via experiments, demonstrating that decision trees can be effective in melanoma diagnosis.

As editors, we hope that this volume focused on analysis of skin lesion images will demonstrate the significant progress that has occurred in this field in recent years. We also hope that the developments reported in this volume will motivate further research in this exciting field.

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Reference

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Computer Vision Techniques for the Diagnosis of Skin
Cancer

Scharcanski, J.; Celebi, M.E. (Eds.)

2014, X, 282 p. 136 illus., 120 illus. in color., Hardcover

ISBN: 978-3-642-39607-6