

PREFACE

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Texture analysis is an important generic research area of machine vision. The potential areas of application include biomedical image analysis, industrial inspection, analysis of satellite or aerial imagery, content-based retrieval from image databases, document analysis, biometric person authentication, scene analysis for robot navigation, texture synthesis for computer graphics and animation, and image coding. Texture analysis has been a topic of intensive research for over three decades, but the progress has been very slow. The analysis of real world textures has turned out to be a very difficult problem, and there are only a limited number of examples of successful exploitation of texture.

A Workshop on Texture Analysis in Machine Vision was arranged at the University of Oulu, Finland, on June 14-15, 1999. The aim was to provide a forum for presenting recent research results and for discussing how to make progress in order to increase the usefulness of texture in practical applications. The program of the workshop included keynote presentations by professors Rama Chellappa (University of Maryland, USA) and Anil K. Jain (Michigan State University, USA), contributed papers describing recent progress in this field, and a panel on future research directions.

This book contains extended and revised versions of the papers presented in the workshop. The first part of the book deals with texture analysis methodology, while the second part covers various applications.

In Chapter 1, Pietikäinen and Ojala present an overview of their nonparametric approach to texture analysis based on local binary patterns and signed gray-level differences. Rehrauer and Datcu then propose a scale selection algorithm based on a multi-scale random field model with a dynamic pyramidal structure. The paper from Mościńska and Tyma in Chapter 3 presents a two stage method for texture segmentation using estimated GMRF parameters for rough segmentation and neural networks for postprocessing.

In Chapter 4, Battiato and Gallo describe a nonparametric multiresolution approach for the analysis/synthesis of textures. A texture classification system using statistical and soft-computing methods is then proposed by Stolpmann and Dooley. Chapter 6, by Chetverikov and Földvári, considers the problem of affine-invariant texture classification using regularity features, and Soriano *et al.* deal with

classification of tilted rough textures using local binary pattern operators. Finlayson and Tian discuss the results of a psychological study on color texture similarity. In Chapter 9, Botchko *et al.* propose an approach for virtual coloring of multispectral textures.

The second part of the book concerning applications begins with image retrieval and document analysis. In Chapter 10, Aksoy and Haralick consider both macro and micro aspects of texture in their approach to image similarity and retrieval. Leow and Lai propose a scale and orientation-invariant method for image retrieval based on Gabor filtering, and Okun and Pietikäinen present a survey on texture-based methods for document image analysis.

Applications in biomedical image analysis are considered in three papers. Chapter 13 by Yuen *et al.* deals with tongue texture analysis of traditional Chinese medicine using wavelet opponent color features. Materka *et al.* are concerned with analyzing X-ray images for the detection of bone mass and structure. In Chapter 15, Materka *et al.* consider texture analysis of test object (phantom) images for the standardization of *in vivo* magnetic resonance imaging.

Industrial inspection applications are represented by four papers. In Chapter 16, Silvéen overviews the problems of applying texture analysis to industrial inspection. Schael and Burkhardt propose two methods for the automatic detection of errors on non-stochastic textures using invariant gray scale features and polynomial classifiers. In Chapter 18 Iivarinen presents a simple approach to surface defect segmentation based on local binary pattern texture measures and self-organizing map classification. Telfer describes a method for angular texture discrimination of woodgrain imagery using a directionally selective local feature statistics operator.

Finally, Chapter 20 by Ollila *et al.* combines the analysis and synthesis of textures with applications in the animation industry.

In summary, this book gives a unique view of different approaches and applications of texture analysis. It should be of great interest both to researchers of machine vision and to practitioners in various application areas.

I would like to thank all those whose contributions made this book possible, including the authors of the papers, the program and organizing committee members, and the reviewers of the workshop held in Oulu.