

Preface

The secret to getting ahead is getting started.

Mark Twain

This book is the result of many years of teaching image processing and fuzzy logic taught by the authors for undergraduate courses. Most of the material used is also the result of fertile interactions with the students whose case studies contributed a lot in the Java implementation of algorithms and methods. The volume has been conceived as a gentle introduction to fuzzy logic approaches useful in image processing tasks.

First we describe image processing algorithms based on fuzzy logic under a methodological point of view. Then, we provide some practical applications without passing over the important formal details. We tried to identify the most important works that researchers have done in the area of fuzzy image processing, and we described and illustrated them through Java examples that the interested readers can easily follow.

The book covers both theoretical and practical applications of fuzzy techniques in image processing. Accordingly, the chapters have been grouped into two parts: *Fundamentals of Fuzzy Image Processing* and *Applications to Image Processing*.

In the first part, we explain how image processing can take advantage of fuzzy logic, giving basic theoretical aspects of both fuzzy logic and image processing through five chapters. Chapter 1 is devoted to the basics of image representation using Java. Chapter 2 deals with low-level image processing. In Chap. 3 the reader will find the basic concepts of fuzzy logic, starting from fuzzy set theory up to fuzzy systems. Chapter 4 discusses the issue of vagueness in digital images, that is the motivation of using fuzzy techniques to process images. Finally, Chap. 5 introduces the Java language and its use for image processing.

In the second part, we present four chapters covering different image processing tasks, namely color contrast enhancement, image segmentation, morphological analysis, and image thresholding. For each task an example of practical application

is described. Some examples are presented in the medical domain, using light microscope images provided by the *Dipartimento di Endocrinologia ed Oncologia Molecolare e Clinica* of the University “Federico II” of Naples, Italy. Lastly, the appendix provides some Java code examples that the user can easily run which will help create a concrete feeling of the potential fuzzy image processing.

We believe that this volume will provide a state-of-art coverage of various aspects related to fuzzy image processing and show the potential of fuzzy techniques in solving image processing problems. We hope this book will serve as a reference for scientists and students in this area, as well as a means to stimulate some new ideas for researchers.

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A Gentle Introduction Using Java

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