Preface

Digital geometry is a modern mathematical discipline studying the geometric properties of digital objects (usually modeled by sets of points with integer coordinates) and providing methods for solving various problems defined on such objects. Digital geometry is developed with the explicit goal to provide rigorous mathematical foundations and basic algorithms for applied disciplines such as computer graphics, medical imaging, pattern recognition, image analysis and processing, computer vision, image understanding, and biometrics. These are in turn applicable to important and societally sensitive areas like medicine, defense, and security.

Although digital geometry has its roots in several classical disciplines (such as graph theory, topology, number theory, and Euclidean and analytic geometry), it was established as an independent subject only in the last few decades. Several researchers have played a pioneering role in setting the foundations of digital geometry. Notable among these is the late Azriel Rosenfeld and his seminal works from the late 60's and early 70's of the last century. Some authors of chapters of the present book are also among the founders of the area or its prominent promoters. The last two decades feature an increasing number of active contributors throughout the world. A number of excellent monographs and hundreds of research papers have been devoted to the subject. One can legitimately say that at present digital geometry is an independent subject with its own history, vibrant international community, regular scientific meetings and events, and, most importantly, serious scientific achievements.

This contributed book contains thirteen chapters devoted to different (although interrelated) important problems of digital geometry, algorithms for their solution, and various applications. All authors are well-recognized researchers, as some of them are world leaders in the field. As a general framework, each chapter presents a research topic of considerable importance, provides a review of fundamental results and algorithms for the considered problems, presents new unpublished results, as well as a discussion on related applications, current developments and perspectives. By its structure and content, this publication does not appear to be an exhaustive source of information for all branches of digital geometry. Rather, the book is aimed at attracting readers' attention to central digital geometry tasks and related

applications, as diverse as creating image-based metrology, proposing new tools for processing multidimensional images, studying topological transformations for image processing, and developing algorithms for shape analysis.

An advantage of the chosen contributed book framework is that all chapters provide enough complete presentations written by leading experts on the considered specific matters. The chapters are self-contained and can be studied in succession dictated by the readers' interests and preferences.

We believe that this publication would be a useful source of information for researchers in digital geometry as well as for practitioners in related applied disciplines. It can also be used as a supplementary material or a text for graduate or upper level undergraduate courses.

We would like to thank all those who made this publication possible. We are indebted to João Manuel R.S. Tavares and Renato Manuel Natal Jorge, editors of the Springer's series "Lecture Notes in Computational Vision and Biomechanics," for inviting us to organize and edit a volume of the series. We are thankful to Springer's Office and particularly to Ms. Nathalie Jacobs, Senior Publishing Editor, and Dr. D. Merkle, Editorial Director, for reviewing our proposal and giving us the opportunity to publish this work with Springer, as well as for the pleasant cooperation throughout the editorial process. Lastly and most importantly, our thanks go to all authors who contributed excellent chapters to this book.

Fredonia and Buffalo, NY, USA   Valentin E. Brimkov
                                                                          Reneta P. Barneva

Springer