Preface

During the past decade digital imaging has significantly progressed in all imaging areas ranging from medicine, pharmacy, chemistry, biology to astrophysics, meteorology and geophysics. The avalanche of digitized images produced a need for special techniques of processing and knowledge extraction from many digital images with minimal or even without human interaction. This has resulted in a new area in the digital processing called pattern recognition that becomes increasingly necessary owing to a growing number of images to be processed. The first applications of pattern recognition techniques were for the analysis of medical X-rays and MMR images that enabled the extraction of quantified information in terms of texture, intensity and shape and allowed to significantly improve a diagnosis of human organs. These techniques were significantly developed over the last few years and combined feature detection and classification by using region based and artificial intelligence methods. By using growing databases of medical images processed with pattern recognition and classification techniques, one can produce fast and consistent diagnosis of diseases based on the accumulated knowledge obtained from many other similar cases from the stored databases.

The use of CCD cameras for astrophysical instruments on the ground and space produce digitized images in various fields of astrophysics. In the past decade, many space and ground-based instruments provide large numbers of digitized images of the night skies and of the Sun, our closest star. These images provide more and more valuable knowledge about the evolution of celestial bodies and the physical processes occurring in them. This ample information can be processed with relatively new methods of feature recognition and classification developed in other imaging fields. With every new instrument and space mission, the archives of digital images are growing enormously in size. This imposes increasing requirements for the development of automated pattern recognition methods in applications to these archives.

The progress in digital imaging led to the application of pattern recognition techniques developed for medical and biomedical image to astrophysical images. They have proven to be the revolutionary way for the data processing in astrophysics and solar physics. In spite of difference

between the images in medicine, astrophysics and solar physics, there are many common approaches and techniques that are applicable to them all while some alterations are required to accommodate differences in the specific data.

Unlike features in medical images that are, in a general way, understood by wider range of readers as related to a human body, astrophysical and solar images contain the information about physical processes in the stars and the Sun that often affect the Earth and many aspects of human lives. These processes can be also uncovered with the pattern recognition techniques similar to those applicable to medical images but modified to accommodate the differences in recognized patterns. This book makes use of domain knowledge in astrophysical and medical image processing areas by employing the techniques used for general object recognition for an automated recognition of the features on astrophysical and medical images.

The book is intended for astrophysicists, medical researches, engineers, research students and technically aware managers in the Universities, Astrophysical Observatories, Medical Research Centres working on the processing of large archives of astrophysical or medical digital images. This book can be used as a text book for students of Computing, Cybernetics, Applied Mathematics and Astrophysics.

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Editors

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