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Panos M. Pardalos • Thomas F. Coleman  
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# Optimization and Data Analysis in Biomedical Informatics



The Fields Institute for Research  
in the Mathematical Sciences



Springer

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# Preface

As science and society as a whole become more and more information intensive, there is an urgent need to develop, create, and apply new algorithms and methods to model, manage, and interpret this information. This is nowhere more evident than in biomedicine, where clinicians and scientists are routinely faced with conflicting (sometimes contradictory) sources of knowledge, in addition to the overwhelming and ever increasing stream of data. Bioinformatics and the -omics (genomics, proteomics, etc.) herald the advent of a new era and a new paradigm for scientific and, in particular, biomedical research. Together with the tools developed in optimization theory and the mathematical sciences, we are at a crossroads, where a more fundamental understanding of biological processes is within our grasp. This understanding will certainly pave the way for a more systematic attack on the mechanics of diseases, as opposed to a naive treatment of their symptoms (which has been the hallmark of classical medicine). It seems clear that there is an urgent need in biomedicine for new methods that will make sense out of clinical and experimental data that can be used to learn and generate rational hypotheses from the data and hence to advance the underlying disciplines.

In this volume we cover some of the topics that are related to this emerging and rapidly growing field. In June 11–12, 2010, we organized a Workshop on Optimization and Data Analysis in Biomedical Informatics at the Fields Institute. Following this event we gathered invited contributions based on the talks presented at the workshop and additional invited chapters from world leading experts. We asked the authors to share their expertise in the form of state-of-the-art research and review chapters. Our goal was to bring together researchers from different areas and emphasize the value of mathematical methods in the areas of clinical sciences. This volume is targeted to applied mathematicians, computer scientists, industrial engineers, and clinical scientists who are interested in exploring emerging and fascinating interdisciplinary topics of research. We hope that this book will stimulate and enhance fruitful collaborations between scientists from different disciplines. The editors would like to acknowledge the Fields Institute for their financial support

and hospitality. In addition, we would like to thank all the authors of the invited chapters as well as Mrs. Debbie Iscoe for her valuable help during the editing of this volume.

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