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Editor

Geometric Methods in Bio-Medical Image Processing

With 70 Figures, 18 in Color

Springer

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Preface

It gives me great pleasure to edit this book. The genesis of this book goes back to the conference held at the University of Bologna in June 1999, on collaborative work between the University of California at Berkeley and the University of Bologna. The original idea was to invite some speakers at the conference to submit articles to the book. The scope of the book was later enhanced and, in the present form, it is a compilation of some of the recent work using geometric partial differential equations and the level set methodology in medical and biomedical image analysis.

The synopsis of the book is as follows: In the first chapter, R. Malladi and J. A. Sethian point to the origins of the use of level set methods and geometric PDEs for segmentation, and present fast methods for shape segmentation in both medical and biomedical image applications. In Chapter 2, C. Ortiz de Solorzano, R. Malladi, and S. J. Lockett describe a body of work that was done over the past couple of years at the Lawrence Berkeley National Laboratory on applications of level set methods in the study and understanding of confocal microscope imagery. The work in Chapter 3 by A. Sarti, C. Lamberti, and R. Malladi addresses the problem of understanding difficult time varying echocardiographic imagery. This work presents various level set models that are designed to fit a variety of imaging situations, i.e. time varying $2D$, $3D$, and time varying $3D$. In Chapter 4, L. Vese and T. F. Chan present a segmentation model without edges and also show extensions to the Mumford-Shah model. This model is particularly powerful in certain applications when comparisons between normal and abnormal subjects is required. Next, in Chapter 5, A. Elad and R. Kimmel use the fast marching method on triangulated domain to build a technique to unfold the cortex and map it onto a sphere. This technique is motivated in part by new advances in fMRI based neuroimaging. In Chapter 6, T. Deschamps and L. D. Cohen present a minimal path based method of grouping connected components and show clever applications in vessel detection in $3D$ medical data. Finally, in Chapter 7, A. Sarti, K. Mikula, F. Sgallari, and C. Lamberti, describe a nonlinear model for filtering time varying $3D$ medical data and show impressive results in both ultrasound and echo images.

I owe a debt of gratitude to Claudio Lamberti and Alessandro Sarti for inviting me to Bologna, and logistical support for the conference. I thank the contributing authors for their enthusiasm and flexibility, the Springer mathematics editor Martin Peters for his optimism and patience, and J. A. Sethian for his unfailing support, good humor, and guidance through the years.

Berkeley, California *R. Malladi*
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