PREFACE

This volume carries the same flavor as Volume 1 in covering the theory, algorithms, and applications of level sets and deformable models in medical image analysis.

Chapter 1 describes a new approach that integrates the T-Surfaces model and isosurface generation methods within a general framework for segmentation and surface reconstruction in 3D medical images.

Chapter 2 is a study of active contour models in medical image analysis. Various issues with respect to implantation are discussed.

Chapter 3 also deals with active contours with a primary focus on the application and performance of different types of deformable models for analyzing microscopic pathology specimens.

Chapter 4 focuses on construction of the speed function of level sets as applied to segmentation of tagged MR images.

Chapter 5 presents a parallel computational method for 3D image segmentation based on solving the Riemannian mean curvature flow of graphs. The method is applied to segmentation of 3D echocardiographic images.

Chapter 6 provides a review of the level set method and shows the usage of shape models for segmentation of objects in 2D and 3D within a level set framework via regional information.

Chapter 7 also deals with basic application of deformable models to image segmentation. Various applications of the method are presented.

Chapter 8 employs geometric deformable models/level sets to extract the topology of the shape of breast tumors. Using this framework, several features of breast tumors are extracted and subsequently used for classification of breast disease.

Chapter 9 examines various theoretical and algorithmic details of active contour models and their use for image segmentation.

Chapter 10 uses deformable models to devise a segmentation approach for ultrasound images for the study of prostate cancer.

Chapter 11 proposes a novel variational formulation for brain MRI segmentation that uses J-divergence (symmetrized Kullback-Leibler divergence) to measure the dissimilarity between local and global regions.

Chapter 12 examines the use of shape transformations for morphometric analysis in the brain. A shape transformation is a spatial map that adapts an individual's brain anatomy to that of another.

Chapter 13 proposes a nonlinear statistical shape model for level set segmentation. Various algorithmic details are provided to show the effectiveness of the approach.

Chapter 14 uses the level sets methods for structural analysis of brain white and gray matter in normal and dyslexic people.

Chapter 15 describes an approach for estimating left- and right-ventricular deformation from tagged cardiac magnetic resonance imaging using volumetric deformable models constructed from nonuniform rational B-splines (NURBS).

Chapter 16 is a generalization of the methods presented in Chapter 14 with an emphasis on autism. The 3D distance map is used as a shape descriptor of the white matter, and a novel nonrigid registration approach is used to quantify changes in the corpus callosum of normal and autistic individuals.

Overall, the thirty-one chapters in the two volumes provide an elegant cross-section of the theory and application of variational and PDE approaches in medical image analysis. Graduate students and researchers at various levels of familiarity with these techniques will find the two volumes very useful for understanding the theory and algorithmic implementations. In addition, the various case studies provided demonstrate the power of these techniques in clinical applications.

The editors of the two volumes once again express their deep appreciation to the staff at Springer who made this project a fruitful experience.

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