Various mathematical techniques for analyzing of image data by mathematical models

MÀRIA ŽDÍMALOVÁ*

*Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Bratislava

This contribution deals with the proceeding of the image data and the mathematical approach for processing and analyses of image data. We present medical, biological, and engineering data. Mathematical modeling is a very good and strong tool for the analysis and modeling of this data. Consequently, mathematical modelling brings a good analytical, enumeration, and visualization perspective if representing different types of image data. We discuss some methods for medical image analyses. One point brings perspective from discrete mathematics and discrete algorithms, dealing with graph theory, discrete mathematics, statistics, aggregation functions for image data analyses. We focus on the analyses of the techniques, using image processing and segmentation of the detected objects. We also mention machine learning approach for image data processing. A machine learning-based segmentation technique is required to get good performance to deal with biological images. Through semantic segmentation, regions of interest can be identified for cell assessment. Clinicians can use segmentation results to identify abnormal cell and improve therapy planning. The creation of high-quality labelled and annotated datasets is a critical part of achieving the algorithmic goal of automated medical image segmentation. We also consider a bottom-up aggregation procedure in which regions are merged based on probabilistic considerations. Here we use the merge strategy suggested for the Segmentation by Weighted Aggregation denoted also (SWA) algorithm which employs a hierarchy construction procedure inspired by Algebraic Multigrid solutions for differential equations. The SWA algorithm begins with a weighted graph representing image pixels, and in a sequence of steps creates a hierarchy of smaller ("coarse") graphs with soft relations between nodes at subsequent levels. The framework of the aggregation-based segmentation utilizes adaptive parametric distributions whose parameters are estimated locally using image information. Segmentation relies on an integration of intensity and texture cues, with priors determined by the geometry of

the regions. The method is modular and can readily be extended to handle additional cues. In this work we have a cooperation with Medical Faculty of Comenius University in Bratislava, Slovakia. We cooperate with the Institute of Immunology, the Institute of Anatomy, the Institute of Medical Physics, Biophysics, Informatics and Telemedicine. Image data comes from Comenius University, from Medical Faculty.

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