Image processing by discrete mathematical algorithms

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Abstract

In this talk we present innovative approach to image processing from discrete mathematics. We present algorithms dealing with image analyses. Algorithms are based on discrete mathematics as well as graph theory. We deal with graph theoretical algorithms algorithms using max flow algorithms in the networks and Dijskra's algorithm in intelligent scissors. Speccialy we focusse on Graph Cut algorithm and the algorithm called Intelligent scissors. We analyse biological data, cells, membranes of cells, radar data and others. In this work we have a cooperation with Medical Faculty of Commenius University in Bratislava. We cooperate with the Institute of Imunology, the Institute of Anatomy, the Institute of Medical Physics, Biophysics, Informatics and Telemedicine. We implemented, optimized and also creted new softwares on speccial requests of biological and medical data scientist. Some data were extracted also on microscops on Medical faculty and also results were verified by the doctors and bilogists.

Consequently we propose others applications in biology, medicine and geography. Our next aim is to exceed this work into analyses of technical materials and buildings.

In this last part we focuse on one speccial algoritm, called GrabCut. This algorithm is based on the combining of graph cut methods, data clustering (k – menas algorithm), mixture models and also image processing. We combine statistics, data clustering, Gaussian mixture models, and also image segmentation techniques. Consequenly we apply these techniques into the analyses of medical and biological image data. We provide a better segmnetation on these data sets.

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Biography

My webpage: https://www.math.sk/wiki/zdimalova

Education

- 2019 June, doc. Degree, Associate professor, field: Applied Mathematics
- Slovak University of Technology in Bratislava, Faculty of Civil Engineering
- Department of Mathematics and Descriptive Geometry, Slovakia
- Title of the Dissertation: Large networks and their properties
- 2010 November, Ph.D. Degree, Applied Mathematics, Slovak University of Technology in Bratislava, Faculty of Civil Engineering, Department of Mathematics and Descriptive Geometry, Slovakia

- Title of the Dissertation: Large vertex – transitive and Cayley graphs and digraphs of given degree and diameter
- 2003 – 2009 Ph.D. Studies at Slovak University of Technology in Bratislava, Slovakia, Faculty of Civil Engineering, Department of Mathematics and Descriptive geometry
- 2003MSc. Degree, Comenius University in Bratislava, Slovakia, Faculty of Mathematics, Physics and Computer Science
- 1998 – 2003 Master Studies, Mathematics and Physics
- Additional information on education: 2006 – 2007 E – learning courses from Projective Geometry and Chapters for Teaching of the Mathematics – certificates, Comenius University in Bratislava

Research

- Graph Theory
- Uncertainty Modelling
- Graph Cutting
- Data Mining
- Education in Mathematics
- Bio-Informatic

Maria Zdimalova currently works at the Department of Mathematics and Constructive Geometry, Slovak University of Technology in Bratislava. Maria does research in Applied Mathematics, Algebra and Graph Theory. Their current project is 'Arch Math: Mathematics and Architecture, Design, Fashion, Art,.' Algebraic Graph Theory as well as Graph Algorithms in Image Processing.

Disciplines

- Applied Mathematics Skills and expertise
- Discrete Mathematics, Graph Theory, Applied Mathematics, Combinatorics, Algebra, Graph Algorithms, Graphs, Uncertainty Analysis, Image Processing, Mathematics Education, Uncertainty, ART IN MMATH, Theoretical Computer Science, Mathematical Modelling Languages
- German, English, Czech

A member of Editorial Team:

- Indonesian Journal of Combinatorics http://www.ijc.or.id/index.php/ijc, Indonesia
- Wisaarkhu magazine https://wisaarkhu.co.za/ https://wisaarkhu.co.za/about/meet-the-team/, South Afrika

Reviewer Board:

- Symmetry https://www.mdpi.com/journal/symmetry/submission_reviewers

Revisions: she partipcipated in of the committe in the international Czech – Slovak student university many years and 2018, 201(in Italy for 2019- Faces of Geometries, Member of scientific committe of the conference From Agnesi to Mirzikhani, Milano, Polytecnica de Milano, May, Italy 2020- Faces of Geometries, II Second Edition, Member of scientific comitte of the conference From Agnesi to Mirzikhani, Milano, Polytecnica de Milano, May, Italy

External examiner for PHD:

- South Afrika
- Ethiopia, Afrika

Project: Bio - informatics: Graph theory approach and others methods to image processing and project Arch Math
Publications, more than 50 international scientific journals, 30 indexed in Scopus and Wos.