Editorial Board

David Hutchison
   Lancaster University, UK
Takeo Kanade
   Carnegie Mellon University, Pittsburgh, PA, USA
Josef Kittler
   University of Surrey, Guildford, UK
Jon M. Kleinberg
   Cornell University, Ithaca, NY, USA
Friedemann Mattern
   ETH Zurich, Switzerland
John C. Mitchell
   Stanford University, CA, USA
Moni Naor
   Weizmann Institute of Science, Rehovot, Israel
Oscar Nierstrasz
   University of Bern, Switzerland
C. Pandu Rangan
   Indian Institute of Technology, Madras, India
Bernhard Steffen
   University of Dortmund, Germany
Madhu Sudan
   Massachusetts Institute of Technology, MA, USA
Demetri Terzopoulos
   University of California, Los Angeles, CA, USA
Doug Tygar
   University of California, Berkeley, CA, USA
Moshe Y. Vardi
   Rice University, Houston, TX, USA
Gerhard Weikum
   Max-Planck Institute of Computer Science, Saarbruecken, Germany
Preface

DGCI 2006, the 13th in a series of international conferences on Discrete Geometry for Computer Imagery, was held in Szeged, Hungary, October 25-27, 2006. DGCI 2006 attracted a large number of research contributions from academic and research institutions in this field. In fact, 99 papers were submitted from all around the world. After review, 55 contributions were accepted from which 28 were selected for oral and 27 for poster presentation. All accepted contributions were scheduled in single-track sessions. The program was enriched by three invited lectures, presented by internationally well-known speakers: Jean-Marc Chassery (Domaine Universitaire Grenoble, France), T. Yung Kong (City University of New York, USA), and László Lovász (Eötvös Loránd University, Budapest, Hungary).

We were pleased that DGCI got the sponsorship of the International Association of Pattern Recognition (IAPR). DGCI 2006 is also a conference associated with the IAPR Technical Committee on Discrete Geometry (TC18). Hereby, we would like to thank all contributors, the invited speakers, all reviewers and members of the Steering and Program Committees, and all supporting personnel who made the conference happen. We are also grateful to the Institute of Informatics, University of Szeged, for the financial and infrastructural help, which was essential to the organization of a successful conference. Finally, we thank all the participants and hope that they found interest in the scientific program and also that they had a pleasant stay in Szeged.

October 2006

Attila Kuba
László G. Nyúl
Kálmán Palágyi
<table>
<thead>
<tr>
<th>Edition</th>
<th>Venue</th>
<th>Date</th>
<th>Proc.</th>
<th>Editors / Organizers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hungary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th</td>
<td>Poitiers,</td>
<td>Apr. 13–15, 2005</td>
<td>LNCS 3429</td>
<td>E. Andres, G. Damiand, P. Lienhardt</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11th</td>
<td>Naples,</td>
<td>Nov. 19–21, 2003</td>
<td>LNCS 2886</td>
<td>I. Nyström, G. Sanniti di Baja, S. Svensson</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10th</td>
<td>Bordeaux,</td>
<td>Apr. 3–5, 2002</td>
<td>LNCS 2886</td>
<td>A. Braquelaire, J.-O. Lauchaud, A. Vialard</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sweden</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8th</td>
<td>Marne-la-Vallée,</td>
<td>Mar. 17–19, 1999</td>
<td>LNCS 1568</td>
<td>G. Bertrand, M. Couprie, L. Perroton</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7th</td>
<td>Montpellier,</td>
<td>Dec. 3–5, 1997</td>
<td>LNCS 1347</td>
<td>E. Ahronovitz, C. Fiorio</td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>France</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DGCI 2006 was organized by the Department of Image Processing and Computer Graphics, University of Szeged, Hungary.

**Organizing Committee**

Attila Kuba  
László G. Nyúl  
Kálmán Palágyi  
University of Szeged, Hungary

**Steering Committee**

Eric Andres  
Gunilla Borgefors  
Achille Braquelaire  
Jean-Marc Chassery  
Annick Montanvert  
Gabriella Sanniti di Baja  
Université de Poitiers, France  
Swedish University of Agricultural Sciences, Uppsala, Sweden  
Université Bordeaux 1, France  
Domaine Universitaire Grenoble, France  
Istituto di Cibernetica “E. Caianiello” del CNR, Pozzuoli (Naples), Italy

**Program Committee**

Reneta Barneva  
Gilles Bertrand  
Valentin E. Brimkov  
David Coeurjolly  
Michel Couprie  
Leila De Floriani  
Isabelle Debled-Rennesson  
Ulrich Eckhardt  
Oscar Figueiredo  
Christophe Fiorio  
Atsushi Imiya  
Pieter Jonker  
SUNY College at Fredonia, Fredonia, USA  
Groupe ESIEE, Noisy-le-Grand, France  
SUNY Buffalo State College, Buffalo, USA  
Université Claude Bernard Lyon 1, Villeurbanne, France  
Groupe ESIEE, Noisy-le-Grand, France  
Dipartimento di Informatica e Scienze dell’Informazione, Genova, Italy  
LORIA Nancy, Vandœuvre-lès-Nancy Cedex, France  
Universität Hamburg, Germany  
École Supérieure Chimie Physique Électronique de Lyon, France  
Universitaire de Montpellier, France  
Chiba University, Japan  
Delft University of Technology, The Netherlands
VIII Organization

Ron Kimmel
Christer O. Kiselman
Reinhard Klette
Walter G. Kropatsch
Jacques-Olivier Lachaud
Gregoire Malandain
Remy Malgouyres
Serge Migueth
Ingela Nyström
Pierre Soille

Edouard Thiel

Technion, Haifa, Israel
Uppsala University, Sweden
The University of Auckland, New Zealand
Vienna University of Technology, Austria
Université Bordeaux 1, France
INRIA, Sophia-Antipolis, France
GREYC, ISMRA, Aubiere, France
Université Lumières Lyon 2, Bron, France
Uppsala University, Sweden
Joint Research Centre of the European Commission, Ispra (VA), Italy
Université de la Méditerranée Aix-Marseille 2, France

Referees

Eric Andres
Reneta Barneva
Gilles Bertrand
Gunilla Borgefors
Achille Braquelaire
Valentin E. Brimkov
Jean-Marc Chassery
Pierre Chatelier
David Coeurjolly
Michel Couprie
Jean Cousty
Emanuele Danovaro
Leila De Floriani
Isabelle Debled-Rennesson
Eric Domenjoud
Ulrich Eckhardt
Fabien Feschet
Oscar Figueiredo
Christophe Fiorio
Céline Fouard
Pierre-Marie Gandoin
Yan Gérard
Yll Haxhimusa
Atsushi Imiya
Adrian Ion
Pieter Jonker
Zoltán Kató

Yukiko Kenmochi
Bertrand Kerautret
Ron Kimmel
Christer O. Kiselman
Reinhard Klette
Walter G. Kropatsch
Attila Kuba
Jacques-Olivier Lachaud
Gaëlle Largeteau-Skapin
Gregoire Malandain
Remy Malgouyres
Serge Migueth
Annick Montanvert
Ingela Nyström
László G. Nyúl
Kálmán Palágyi
Laura Papaleo
Gabriella Sanniti di Baja
Isabelle Sivignon
Pierre Soille
Robin Strand
Stina Svensson
Hugues Talbot
Edouard Thiel
Laure Tougne
Jean-Luc Toutant
# Table of Contents

## Discrete Geometry

**Invited Paper**

Duality and Geometry Straightness, Characterization and Envelope .......................... 1  
*J.-M. Chassery, D. Coeurjolly, I. Sivignon*

On Minimal Perimeter Polyminoes ................................................................. 17  
*Y. Altshuler, V. Yanovsky, D. Vainsencher, I.A. Wagner, A.M. Bruckstein*

A Generic Approach for n-Dimensional Digital Lines ........................................ 29  
*F. Feschet, J.-P. Reveillès*

Two Discrete-Euclidean Operations Based on the Scaling Transform ........................ 41  
*G. Largeteau-Skapin, E. Andres*

Geometry of Neighborhood Sequences in Hexagonal Grid .................................... 53  
*B. Nagy*

Recognition of Blurred Pieces of Discrete Planes ............................................. 65  
*L. Provot, L. Buzer, I. Debled-Rennesson*

## Discrete Tomography

The Number of Line-Convex Directed Polyominoes Having the Same Orthogonal Projections ................................................................. 77  
*P. Balázs*

A Network Flow Algorithm for Binary Image Reconstruction from Few Projections ................................................................. 86  
*K.J. Batenburg*

Fast Filling Operations Used in the Reconstruction of Convex Lattice Sets ................ 98  
*S. Brunetti, A. Daurat, A. Kuba*

Reconstruction Algorithm and Switching Graph for Two-Projection Tomography with Prohibited Subregion ............................................. 110  
*A. Kaneko, R. Nagahama*
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Geometry Driven Reconstruction Algorithm for the Mojette Transform</td>
<td>122</td>
</tr>
<tr>
<td>N. Normand, A. Kingston, P. Évenou</td>
<td></td>
</tr>
<tr>
<td>Quantised Angular Momentum Vectors and Projection Angle Distributions for Discrete Radon Transformations</td>
<td>134</td>
</tr>
<tr>
<td>I. Svalbe, S. Chandra, A. Kingston, J.-P. Guédon</td>
<td></td>
</tr>
<tr>
<td>A Benchmark Evaluation of Large-Scale Optimization Approaches to Binary Tomography</td>
<td>146</td>
</tr>
<tr>
<td>Construction of Switching Components</td>
<td>157</td>
</tr>
<tr>
<td>S. Zopf</td>
<td></td>
</tr>
<tr>
<td><strong>Discrete Topology</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Invited Paper</strong></td>
<td></td>
</tr>
<tr>
<td>Minimal Non-simple and Minimal Non-cosimple Sets in Binary Images on Cell Complexes</td>
<td>169</td>
</tr>
<tr>
<td>T.Y. Kong</td>
<td></td>
</tr>
<tr>
<td>Combinatorial Relations for Digital Pictures</td>
<td>189</td>
</tr>
<tr>
<td>V.E. Brimkov, D. Moroni, R. Barneva</td>
<td></td>
</tr>
<tr>
<td>Reusing Integer Homology Information of Binary Digital Images</td>
<td>199</td>
</tr>
<tr>
<td>R. González-Díaz, B. Medrano, J. Sánchez-Peláez, P. Real</td>
<td></td>
</tr>
<tr>
<td>On the Lattice Structure of Subsets of Octagonal Neighborhood Sequences in $\mathbb{Z}^n$</td>
<td>211</td>
</tr>
<tr>
<td>A. Hajdu, L. Hajdu</td>
<td></td>
</tr>
<tr>
<td>On the Connectedness of Rational Arithmetic Discrete Hyperplanes</td>
<td>223</td>
</tr>
<tr>
<td>D. Jamet, J.-L. Toutant</td>
<td></td>
</tr>
<tr>
<td>Homology of Simploidal Set</td>
<td>235</td>
</tr>
<tr>
<td>S. Peltier, L. Fuchs, P. Lienhardt</td>
<td></td>
</tr>
<tr>
<td>Measuring Intrinsic Volumes in Digital 3d Images</td>
<td>247</td>
</tr>
<tr>
<td>K. Schladitz, J. Ohser, W. Nagel</td>
<td></td>
</tr>
</tbody>
</table>
Distance

An Objective Comparison Between Gray Weighted Distance Transforms and Weighted Distance Transforms on Curved Spaces .......................... 259
   C. Fouard, M. Gedda

Chordal Axis on Weighted Distance Transforms ................................. 271
   J. Hulin, E. Thiel

Attention-Based Mesh Simplification Using Distance Transforms ........... 283
   S. Mata, L. Pastor, A. Rodríguez

Generating Distance Maps with Neighbourhood Sequences ................. 295
   R. Strand, B. Nagy, C. Fouard, G. Borgefors

Hierarchical Chamfer Matching Based on Propagation of Gradient Strengths .......................................................... 308
   S. Svensson, I.-M. Sintorn

Elliptical Distance Transforms and Applications ............................... 320
   H. Talbot

Image Analysis

A Composite and Quasi Linear Time Method for Digital Plane Recognition .......................................................... 331
   L. Buzer

Fusion Graphs, Region Merging and Watersheds ............................... 343
   J. Cousty, G. Bertrand, M. Couprie, L. Najman

Revisiting Digital Straight Segment Recognition ............................. 355
   F. de Vieilleville, J.-O. Lachaud

On Discrete Moments of Unbounded Order .................................... 367
   R. Klette, J. Žunić

Feature Based Defuzzification in $\mathbb{Z}^2$ and $\mathbb{Z}^3$ Using a Scale Space Approach ............................................. 379
   J. Lindblad, N. Sladoje, T. Lukić

Improving Difference Operators by Local Feature Detection .............. 391
   K. Teelen, P. Veelaert
Shape Representation

An Optimal Algorithm for Detecting Pseudo-squares ................. 403
   S. Brlek, X. Provençal

Optimization Schemes for the Reversible Discrete Volume
Polyhedrization Using Marching Cubes Simplification .............. 413
   D. Coeurjolly, F. Dupont, L. Jospin, I. Sivignon

Arithmetic Discrete Hyperspheres and Separatingness ............ 425
   C. Fiorio, J.-L Toutant

The Eccentricity Transform (of a Digital Shape) .................. 437
   W.G. Kropatsch, A. Ion, Y. Haxhimusa, T. Flanitzer

Projected Area Based 3D Shape Similarity Evaluation ............ 449
   T. Miyake, N. Iwata, S. Horihata, Z. Zhang

Continuous Level of Detail on Graphics Hardware .................. 460
   F. Ramos, M. Chover, O. Ripolles, C. Granell

Topological and Geometrical Reconstruction of Complex Objects
on Irregular Isothetic Grids .................................. 470
   A. Vacavant, D. Coeurjolly, L. Tougne

Fast Polynomial Segmentation of Digitized Curves ............... 482
   P. Veelaert, K. Teelen

Segmentation

Fuzzy Segmentation of Color Video Shots ......................... 494
   B.M. Carvalho, L.M. Oliveira, G.S. Andrade

Application of Surface Topological Segmentation to Seismic Imaging .. 506
   T. Faucon, E. Decencière, C. Magneron

Watershed Segmentation with Chamfer Metric ..................... 518
   V. Goncharenko, A. Tuzikov

Generalized Map Pyramid for Multi-level 3D Image Segmentation .... 530
   C. Grasset-Simon, G. Damiand

Topologically Correct Image Segmentation Using Alpha Shapes .... 542
   P. Stelldinger, U. Köthe, H. Meine
Skeletonization

New Removal Operators for Surface Skeletonization .................. 555
    C. Arcelli, G. Sanniti di Baja, L. Serino

Skeleton Pruning by Contour Partitioning .............................. 567
    X. Bai, L.J. Latecki, W.-Y. Liu

A New 3D Parallel Thinning Scheme Based on Critical Kernels ....... 580
    G. Bertrand, M. Couprie

Order Independence in Binary 2D Homotopic Thinning ................ 592
    M. Iwanowski, P. Soille

Exact Euclidean Medial Axis in Higher Resolution ...................... 605
    A.V. Saúde, M. Couprie, R. Lotufo

Skeletonization and Distance Transforms of 3D Volumes Using Graphics Hardware ......................................................... 617
    M.A.M.M. van Dortmont, H.M.M. van de Wetering, A.C. Telea

Surfaces and Volumes

How to Tile by Dominoes the Boundary of a Polycube ................. 630
    O. Bodini, S. Lefranc

A Generalized Preimage for the Standard and Supercover Digital Hyperplane Recognition ................................................. 639
    M. Dexet, E. Andres

Distance Transforms on Anisotropic Surfaces for Surface Roughness Measurement ................................................................. 651
    L. Ikonen, T. Kuparinen, E. Villanueva, P. Toivanen

A 3D Live-Wire Segmentation Method for Volume Images Using Haptic Interaction ............................................................ 663
    F. Malmberg, E. Vidholm, I. Nyström

Minimal Decomposition of a Digital Surface into Digital Plane Segments Is NP-Hard ....................................................... 674
    I. Sivignon, D. Coeurjolly

Author Index ............................................................................. 687