# GbR 2011

8th IAPR – TC-15 Workshop on Graph-based Representations in Pattern Recognition


May 18-20, 2011
Münster (North Rhine-Westphalia), Germany

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**Workshop Program**

# GbR 2011

## 8th IAPR – TC-15 Workshop on Graph-based Representations in Pattern Recognition

May 18-20, 2011
Münster, Germany

Hosted by:
Institute of Computer Science
University of Münster, Germany

In Cooperation with:
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IAPR
Universität Münster

# GbR 2011

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Miquel Ferrer, Universitat Politècnica de Catalunya, Spain
Andrea Torsello, Università Ca' Foscari Venezia, Italy

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# IAPR Invited Speakers

## Invited Talk 1
## Partial Difference Equations (PdE) on Graphs for Image and Data Processing

Olivier Lezoray
University of Caen, France

In image processing and computer vision, techniques based on energy minimization and Partial Differential Equations (PDEs) have shown their efficiency in solving many important problems, such as smoothing, denoising, interpolation and segmentation. Solutions of such problems can be obtained by considering the input discrete data as continuous functions defined on a continuous domain, and by designing continuous PDEs whose solutions are discretized in order to fit with the natural discrete domain. An alternative methodology to continuous PDEs-based regularization, is to formalize the problem directly in a discrete setting that is not necessarily a grid. However, PDE-based methods are difficult to adapt for data that live on non Euclidean domains since the discretization of the underlying differential operators is difficult for high dimensional data. Problems involving PDEs can be reduced to algebraic ones of a very much simpler structure by replacing the differentials by difference equations on graphs. As a consequence, it is possible to provide methods that mimic on graphs well-known PDE variational formulations under a functional analysis point of view. One way to tackle this is to use Partial difference Equations (PdE) over graphs. Conceptually, PdEs mimic PDEs in domains having a graph structure. Our proposed PdE framework unifies local and nolocal processing of images and allows most PDEs to be extended to graphs. In this talk, I will present nonlocal difference operators on graphs and will use the framework of PdEs to transcribe PDEs on graphs:

- a nonlocal discrete regularization on graphs as a framework for data simplification and interpolation,
- a formulation of mathematical morphology that considers a discrete version of PDEs-based approaches over weighted graphs,
- an adaptation of the Eikonal equation for data clustering and image segmentation.

This talk presents a joint work with A. Elmoataz.

**Invited Talk 2**
**Graph Algorithmic Techniques for**
**Biomedical Image Segmentation: LOGISMOS**

Milan Sonka
University of Iowa, USA

Accurate and reliable image segmentation is of paramount importance in medical image analysis. With a widespread use of 3D/4D imaging modalities like MR, MDCT, ultrasound, or OCT in routine clinical practice, physicians are faced with ever-increasing amounts of image data to analyze and quantitative outcomes of such analyses are increasingly important. Yet, daily interpretation of clinical images is still typically performed visually and qualitatively, with quantitative analysis being an exception rather than the norm. Since performing organ/object segmentations in 3D or 4D is infeasible for a human observer in clinical setting due to the time constraints, quantitative and highly automated analysis methods must be developed. Situation is similar when analyzing research animal images or biological images of living cells from microscopic images. Utilizing contextual information of mutually related surfaces and objects is hypothesized to increase segmentation robustness.

Our method for simultaneous segmentation of multiple interacting surfaces belonging to multiple interacting objects will be presented. The reported method is part of the family of graph-based image segmentation methods dubbed LOGISMOS for Layered Optimal Graph Image Segmentation of multiple Objects and Surfaces. This family of methods guarantees solution optimality with directly applicability to n-D problems. While LOGISMOS is generally applicable to a multitude of image segmentation problems, its utility and performance will be demonstrated on a knee-joint bone and cartilage segmentation task. The framework consists of the following main steps: 1) Shape model construction, 2) Pre-segmentation, 3) Cross-object surface mapping, 4) Multi-object, multi-surface graph construction, and 5) final segmentation and quantitative analysis. The functionality and performance of our method will be demonstrated in 3-D MR images of the knee joint originating from the NIH-supported Osteoarthritis Initiative Study. Additional applications of the methods to cardiovascular MR, pulmonary CT and ophthalmic OCT images will be presented demonstrating the broad applicability of the developed algorithmic concepts.

# GbR 2011 at a Glance

## Wednesday, May 18th

| | |
|---|---|
| 08:00 | Registration |
| 09:00 - 09:20 | Welcome address |
| 09:20 - 10:20 | **Invited speaker 1**: Olivier Lezoray |
| 10:20 - 12:00 | **Poster session 1**: Graph representation and matching |
| 12:00 - 14:00 | Lunch break |
| 14:00 - 16:00 | **Oral session 1**: Graph representations |
| 16:00 - 18:00 | Get-together |

## Thursday, May 19th

| | |
|---|---|
| 09:00 - 10:00 | **Invited speaker 2**: Milan Sonka |
| 10:00 – 12:00 | **Poster session 2**: Segmentation |
| 12:00 - 14:00 | Lunch break |
| 14:00 – 16:00 | **Oral session 2**: Graph matching |
| 16:00 – 18:00 | **Poster session 3**: Graph matching, applications |
| 18:00 | Boat trip to workshop dinner |

## Friday, May 20th

| | |
|---|---|
| 09:00 – 10:35 | **Oral session 3**: Graph-based learning and modeling |
| 10:35 - 11:00 | Coffee break |
| 11:00 - 13:00 | **Challenge session** |
| | **TC meeting** |
| | **Presentation of GbR2013** |
| 13:00 | Lunch |
| | End of GbR2011 |

# GbR 2011 Program in Detail

***Remark: The number in brackets below the starting time of each oral presentation or behind the poster number indicates the page number in the proceedings book.***

## Wednesday, May 18th

08:00 **Registration**

09:00 **Welcome address**

09:20 **Invited Speaker 1**
*Partial Difference Equations (PdE) on graphs for image and data processing*
Olivier Lezoray

**Poster Session 1: Graph representation and matching**
10:20–12:00 Chair: Andrea Torsello

1 (1) *A global method for reducing multidimensional size graphs*
Andrea Cerri, Patrizip Frosini, Walter G. Kropatsch and Claudia Landi

2 (32) *Entropy versus heterogeneity for graphs*
Lin Han, Edwin Hancock and Richard Wilson

3 (72) *Towards perfomance evaluation of graph-based representation*
Salim Jouili and Salvatore Tabbone

4 (82) *Measuring the distance of generalized maps*
Camille Combier, Guillaume Damiand and Christine Solnon

5 (92) *Aggregated search in graph databases: Preliminary results*
Haytham Elghazel and Mohand-Said Hacid

6 (102) *Speeding up graph edit distance computation through fast bipartite matching*
Stefan Fankhauser, Kaspar Riesen and Horst Bunke

7 (122) *Generalized learning graph quantization*
Brijnesh Jain and Klaus Obermayer

**Wednesday, May 18th**

12:00 **Lunch break**

**Oral Session 1: Graph representations**

Chair: Walter Kropatsch

14:00 (22) *1. Mini Tutorial: Graph embedding*
*2. Dimensionality reduction for graph of words embedding*
Jaume Gibert, Ernest Valveny and Horst Bunke

14:45 (12) *Graph descriptors from B-matrix representation*
Wojciech Czech

15:10 (42) *Learning generative graph prototypes using simplified Von Neumann Entropy*
Lin Han, Edwin Hancock and Richard Wilson

15:35 (52) *An information-geometric dissimilarity for graph indexing*
Francisco Escolano, Boyan Bonev and Miguel Angel Lozano

16:00 **Get-together**

## Thursday, May 19th

09:00 **Invited Speaker 2**
*Graph algorithmic techniques for biomedical image segmentation: LOGISMOS*
Milan Sonka

**Poster Session 2:** **Segmentation**
10:00–12:00 Chair: Xiaoyi Jiang

1 (215) *Spatio-temporal extraction of articulated models in a graph pyramid*
Nicole M. Artner, Adrian Ion and Walter Kropatsch:

2 (225) *Semi-supervised segmentation of 3D surfaces using a weighted graph representation*
Filippo Bergamasco, Andrea Albarelli and Andrea Torsello

3 (275) *Automatic street graph construction in sketch maps*
Klaus Broelemann, Xiaoyi Jiang and Angela Schwering

4 (235) *Convexity grouping of salient contours*
Padraig Corcoran and Peter Mooney

5 (245) *Hierarchical interactive image segmentation using irregular pyramids*
Michael Gerstmayer, Yll Haxhimusa and Walter G. Kropatsch

6 (255) *Tiled top-down pyramids and segmentation of large histological images*
Romain Goffe, Luc Brun and Guillaume Damiand

7 (305) *Structure-based evaluation methodology for curvilinear structure detection algorithms*
Xiaoyi Jiang, Martin Lambers and Horst Bunke

8 (265) *Segmentation of similar images using graph matching and community detection*
Charles Iury Oliveira Martins, Roberto Marcondes Cesar Jr., Leonardo Ré Jorge and André Victor Lucci Freitas

**Thursday, May 19th**

12:00 **Lunch break**

**Oral Session 2: Graph matching**

Chair: Edwin Hancock

14:00 (112) *1. Mini tutorial: Graph kernels*
*2. Two new graph kernels and applications to Chemoinformatics*
Benoit Gaüzère, Luc Brun and Didier Villemin

14:45 (285) *People re-identification by graph kernel methods*
Luc Brun, Donatello Conte, Pasquale Foggia and Mario Vento

15:10 (142) *Smooth simultaneous structural graph matching and point-set registration*
Gerard Sanromà, René Alquézar and Francesc Serratosa

15:35 (185) *Indexing with well-founded total order for faster subgraph isomorphism detection*
Markus Weber, Marcus Liwicki and Andreas Dengel

**Poster Session 3: Graph matching, applications**

16:00–18:00 Chair: Edwin Hancock

1 (132) *Parallel graduated assignment algorithm for multiple graph matching based on a common labelling*
David Rodenas, Francesc Serratosa and Albert Sole

2 (152) *Automatic Learning of edit costs based on interactive & adaptive graph recognition*
Francesc Serratosa, Albert Sole and Xavier Cortés

3 (164) *Exploration of the labelling space given graph edit distance costs*
Albert Sole and Francesc Serratosa

4 (175) *Graph matching based on dot product representation of graphs*
Jin Tang, Bo Jiang and Bin Luo

5 (295) *Automatic labeling of handwritten mathematical symbols via expression matching*
Nina Hirata and Willian Honda

6 (315) *Keygraphs for sign detection in indoor environments by mobile phones*
Henrique Morimitsu, Marcelo Hashimoto, Rodrigo B. Pimentel, Roberto M. Cesar-Jr. and Roberto Hirata-Jr

7 (325) *Classification of graph sequences utilizing the eigenvalues of the distance matrices and Hidden Markov Models*
Miriam Schmidt and Friedhelm Schwenker

8 (335) *Using kernels on hierarchical graphs in automatic classification of designs*
Barbara Strug

18:00 **Boat trip to workshop dinner**

## Friday, May 20th

**Oral Session 3:** **Graph-based learning and modeling**

Chair: Luc Brun

09:00 (195) *1. Mini tutorial: Graph transduction*
*2. Transduction as a non-cooperative game*
Aykut Erdem and Marcello Pelillo Graph

09:45 (205) *A graph-based approach to feature selection*
Zhihong Zhang and Edwin Hancock

10:10 (62) *Maximum likelihood for Gaussians on graphs*
Brijnesh Jain and Klaus Obermayer

10:35 **Coffee break**

11:00 **Challenge session** (moderation: Horst Bunke)
**TC meeting**
**Presentation of GbR2013**

13:00 **Lunch, End of GbR2011**

## Notes

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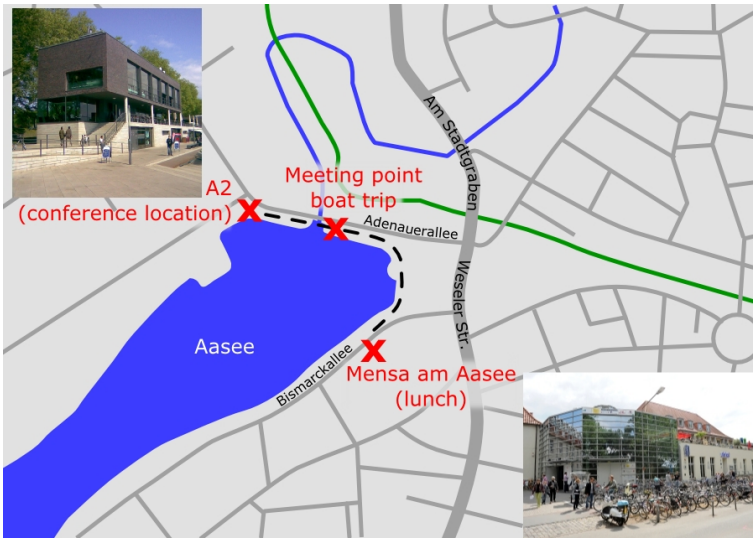
# Additional information

**Social events:**

- Wednesday – Friday: Lunch will be served in the Mensa at Aasee. See the map below.
- Wednesday:  Get-together, 16:00–18:00, in the workshop building.
- Thursday: Workshop dinner, gathering at the meeting point for boat trip at 18:00.




The address of workshop dinner below is listed for your convenience in case you miss the organized boat transportation at 18:00.

Freilichtmuseum Mühlenhof
Theo-Breider-Weg 1
48149 Münster
http://www.muehlenhof-muenster.org/mlhf_index.php

This open-air museum can be reached by walking about 1.5km along Aasee.