IAPR-TC18 - Discrete Geometry and Mathematical Morphology
Interim Report
Period August 2018 - July 2019

Bertrand Kerautret (chair) and Michael Wilkinson (co chair)
with Phuc Ngo (TC18 secretary) and TC18 board

July, 2019

1 Activities during the reference period August 18 - July 19

1.1 New event gathering Discrete Geometry and Mathematical Morphology

In order to facilitate / increase scientific interactions between researchers working in DG and MM, it was decided to initiate a new common event that will be organized for the first time in 2020. A call for proposals was released, and the steering committee has announced that Uppsala (Sweden) was selected to organize the first edition of this event in Fall 2020 (December 10-13, to be confirmed). The event will be chaired by Filip Malmberg (main chair), Nataša Sladoje (program chair) and Joakim Lindblad (Organization Chair). The organisation team is completed by advisors (Robin Strand, Ingela Nyström), honorary chair (Gunilla Borgefors, Christer Kiselman) and assistant (Johan Öfverstedt).

From this new event, we could also expect to increase the quality of scientific interactions. Depending of the its success, the future and frequency of the next iteration of the event will be decided with the support of the TC18 which plays an important role for the interface between the two steering committees of DGCI and ISMM.

1.2 New Project Section on the TC18 Website and Updates

As announced during the TC18 presentations of DGCI a ISMM, a new Project section was added to the website (started from July 2019). The aim of this page is to provide an overview of existing active (or past) projects with relation to DG and MM (national, European or international) and also to add proposition of new collaborations. The members are invited to add their projects by sending us an email with project information or directly apply a Pull Request on this repository. Thanks to the *GitHub* host project that allows to every member to potentially contribute without special account. Moreover, this page can also be used to announce new project construction plans and help to facilitate partnership.

The figure 1 (b) illustrates the new project section containing the list of the project related to DG and MM. All researchers can contribute by mentioning their project by clicking on the edit link that redirect on the HTML source file editable on *GitHub*. Since the set up of the repository 4 members can been seen in the contribution page `https://github.com/TC-18/tc18.org/graphs/contributors`

A new online demonstration and a source code update was updated with a recent new publication to appears in September.

(a) `http://tc18.org`

(b) `http://tc18.org/projects.html`

(c) new activity report page
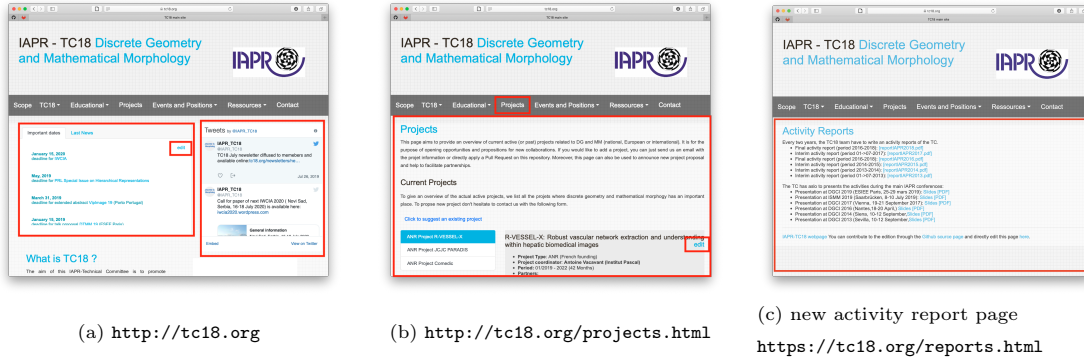
`https://tc18.org/reports.html`

Figure 1: Illustration of the new website components. (a) shows the new twitter feed and merged news and important dates panels. (b) highlights the new project page with the link allowing to edit the project content or project proposal.

1.3 Improved Communication

In order to get a more dynamic and modern communication, a new twitter account was created `@IAPR_TC18` and a call for a *"communication board member"* was send in the last July newsletter (available here: `https://tc18.org/newsletters/newsletterJuly2019.html`). The front page of the main site was also improved with the new twitter feed (see illustration of image (a) of figure 1).

The page organisation was also adjusted to include the new "project" page and a new "Report" page was added in order to propose a direct access to all the activity reports written from 2013 (`https://tc18.org/reports.html`).

To increase reactivity of communication, we favour the direct transmission of announcement instead waiting the edition of next newsletter. We maintain the newsletter and news on IAPR newletter but more defined to adress long term announce.

We also mention the news of this TC with a special IAPR newsletter:

1.4 Member evolution and board

The number of members is actually of 146 (**+12** compared to 2019). This number was mainly increased from the effort made by the board member with the role of *interface between MM and DG and relation with national work group* (Nicolas Passat) who make announcement to invite new members interested to contribute to this TC.

The board with the proposed roles defined in the last final TC18 was well effective. The evolution was mainly the presence of a new secretary (Phuc Ngo) that nicely help to add new members, help in writing newsletters and editing website.

1.5 Finalisation of the RRPR post proceedings

After the second edition of the IAPR workshop RRPR, we completed the proceedings with extended papers of invited contributions. Thanks to this post proceedings, we were able to publish original contributions in relation to reproducible research but also in relation with discrete geometry. More details about this second edition can be fond on the report IAPR (see next section) and the report was published in the IAPR newsletter of October 2018 Vol 40 No 4.

1.6 Special Issues

Several special issues were proposed in conjunction to DGCI and ISMM.

- DGCI special issue: JMIV (closed) Selected papers were invited to extend their DGCI papers. `https://dgci2019.sciencesconf.org/resource/page/id/13`

- ISMM special issue: MMTA (open) Mathematical Morphology - Theory and Applications - Special Issue on ISMM 2019 Submission period of articles 15 May-15 September 2019 (`https://www.degruyter.com/view/j/mathm`)

- IPOL - TC18 special issue: DG & MM (special invitation from DGCI and ISMM papers) Period of submission: postponed to Sept-November. Publication (tentative date): December/January 2020

1.7 New Code Release

After about 10 years of developments, the Dgtal Team was very proud to announce the DGtal 1.0 release. 26 developers have contributed to DGtal and its tools (see https://dgtal.org). Link to this new major version:

- DGtal 1.0: `https://github.com/DGtal-team/DGtal/releases/tag/1.0`

- DGtalTools 1.0: `https://github.com/DGtal-team/DGtalTools/releases/tag/1.0`

1.8 Other Usual Activities

As usual the activities of the TC18 was presented during the main TC18 conferences:

- During DGCI 19 (ESIEE, Paris, France): 27 March 2019, before the poster session. It was presented by Bertrand Kerautret and the support is from the TC18 website:

  `https://tc18.org/files/reportDGCI2019.pdf`

- During ISMM 19 (Saarland University, Saarbrücken, Germany): presented on 9 July 2019 before the poster session. It was presented by Michael Wilkinson and the support is available from the TC18 website:

  `https://tc18.org/files/reportISMM2019.pdf`

2 Reports on Main Past and Forthcoming Events

The actual interim report is exactly after the two main events of this TC: ISMM and DGCI 2019 that allows us to give the two main short reports of the events.

2.1 DGCI 2019 Short Report

The 21th IAPR International Conference on Discrete Geometry for Computer Imagery, DGCI 2019, was held at ESIEE Paris, France, during March 26-28 2019. This conference was organized by Michel Couprie, Jean Cousty, Yukiko Kenmochi and Nabil Mustafa from the ESIEE Paris, Université Paris-Est, France. The DGCI 2019 conference attracted 76 researchers. The scientific program consisted of 3 invited talks, 26 oral and 10 posters presentations during 3 days. This edition attracted 50 submissions by authors from 20 countries: Australia, Austria, Belgium, Brazil, China, France, Hungary, India, Iran, Italy, Japan, The Netherlands, Peru, Poland, Russia, Serbia, Spain, Sweden, UK, and USA

Three keynote speeches were given:

- Alexandre Xavier Falcaõ, from University of Campinas, Brazil, on "The Role of Optimum Connectivity in Image Segmentation: Can the Algorithm Learn Object Information During the Process?"

- Longin Jan Latecki, from Temple University, USA, on "Computing Maximum Weight Cliques with Local Search on Large Graphs with Application to Common Object Discovery"

- János Pach, from Ecole polytechnique fédérale de Lausanne, Switzerland, on "The Blessing of Low Dimensionality"

Loïc Crombez (from Université Clermont Auvergne - LIMOS, France) obtained the best DGCI Student Paper award for his article: Efficient Algorithms to Test Digital Convexity (co authored with Guilherme D. da Fonseca and Yan Gérard).

The full report will available online on the TC website: `http://tc18.org/dgci/report_dgci2019.pdf`

2.2 ISMM 2019 Short Report

The 14th International Symposium on Mathematical Morphology (ISMM 2019), was held in Saarbrücken, Germany, during July 8-10, 2019. The event was organized by Bernhard Burgeth, Andreas Kleefeld, Benoît Naegel, Nicolas Passat, and Benjamin Perret. The ISMM 2019 symposium attracted 70 researchers. The scientific program consisted of 3 invited talks, 24 oral and 16 posters presentations during 3 days. This edition attracted 54 submissions by authors from 16 countries: Austria, Brazil, France, Germany, Greece, India, Italy, The Netherlands, Pakistan, Serbia, South Korea, Spain, Sweden, Tunisia, UK, and USA. Three keynote speeches were given:

- David Coeurjolly (CNRS, LIRIS, Lyon, France): Geometry Processing on Voxel Objects

- Fred A. Hamprecht (IWR, HCI, Heidelberg, Germany): Watershed and Friends in the Age of Deep Learning

- Boguslaw Obara (Durham University, Durham, UK): Combining Mathematical Morphology and the Hilbert Transform for Fully Automatic Nuclei Detection in Fluorescence Microscopy

2.3 RRPR 2018 Short Report

The second edition of the Workshop on Reproducible Research in Pattern Recognition was held in conjunction of ICPR 2018 in Beijing. Compared to the first edition, it followed the same spirit but with a special focus on Digital Geometry and Mathematical Morphology. It was intended as both a short participative course on the RR aspects leading to open discussions with the participants and also on how to actually perform RR. For this second edition, a new call for short paper was proposed to the ICPR authors. The main idea was to give already accepted ICPR authors the possibility to highlight the reproducibility quality of their work with a companion paper including implementation details, source code descriptions, parameter choice etc.

This workshop received a total of 15 papers covering the two main tracks of RR Framework (6 papers) and RR results (3 papers). Six papers were also submitted in the new short paper track. All papers were reviewed by at least 3 reviewers for the main RR result track and the short papers were reviewed by two kinds of review: one for the short paper itself and another coming from the RR label linked to the code repository (when authors apply for the label). A comparable number of participants was present in this workshop with around 20/30 participants and the public was actively participating to the discussions with presenters focusing on RR.

From all these contributions, two invited talks were opening the workshop. The first was related to the evolution and the future of the IPOL journal, including a new structure for machine learning applications. The second invited talk focused on a review of reproducible research platforms with an overview of available, new ways of publications. The three main papers on RR results were oral presentations and 4 short papers were oral fast track presentation. In addition to these new classical presentations, a new type of practical session was proposed by Miguel Colom with an "Hands on IPOL Demonstration System" where users were able to construct their own online demonstration from a simple description file.

The RRPR workshop chairs made the decision to handle the edition of their own post proceedings (in Springer LNCS) allowing the publication of carefully revised papers and integrating improved content with invited paper contributions. The proceedings are going to be send to springer for publication in November. Finally, the "Reproducible Label in Pattern Recognition" defined to highlight the reproducible aspects of the RRPR and ICPR works was once again proposed and will remain active with currently 7 submissions (`https://github.com/RLPR`).

2.4 Other Events

CTIC 2019 : 7th Workshop on Computational Topology in Image Context
The 7th Workshop on Computational Topology in Image Context CTIC2019 was hold in Malaga, Spain on January 24-25, 2019. The CTIC workshops deals with subjects like Topological features and invariants and their computation for digital images Topological algorithms for image processing, mage segmentation under topological constraints etc. The event received 21 submissions and 14 were accepted for oral presentation. The proceedings were published in the LNCS Springer proceedings.

The invited talks were the following:

- **Herbert Edelsbrunner**: Stochastic Geometry topological and experimental (`http://www.ctic2019.uma.es/assets/1^_H-Edelsbrunner.pdf`)

- **Carme Torras**: Challenges in Cloth Manipulation by Robots (`http://www.ctic2019.uma.es/assets/13^_C-Torras.pdf`)

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`http://www.ctic2019.uma.es`

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IWCIA 2019 :
The 19th Workshop on Workshop on Combinatorial Image Analysis IWCIA 2018 was hold in Porto, Portugal on November 22-24, 2018. The presented papers (18) were grouped into two main parts: a first group contains nine papers dealing with theoretical foundations of combinatorial image (like digital geometry, topology...) and the second was including nine papers oriented from the application context (like tomography, segmentation, medical imaging).

The invited talks were the following:

- **José M. Bioucas-Dias**, Universidade de Lisboa, Portugal: *"Patch-based Inverse Problems in Interferometric Phase Imaging "*

- **Jan Kratochvil**, Charles University, Czech Republic: *Geometric Representations of Graphs*

- **Nicolai Petkov**, University of Groningen, The Netherlands: *Representation learning with trainable COSFIRE filters*

<div align="center">https://sites.google.com/view/iwcia18/</div>

MTA 2009: 13th Edition on Meeting on Tomography and Applications Discrete Tomography, Neuroscience and Image Reconstruction
The aim of the Meeting is to share interdisciplinary aspects between the experimental research concerning X-ray tomography and the mathematical image reconstruction community. For this edition several members of TC18 were invited to present recent works:

- **Yan Gerard**, Université d'Auvergne: *"Polynomial Time Reconstruction of Regular Convex Lattice Sets from their Horizontal and Vertical X-Rays"*

- **Jacques-Olivier Lachaud**, Université de Savoie, LAMA: *"Digital convexity and digital planarity, global and local perspectives"*

- **Bertrand Kerautret**, Université Lumière Lyon 2, LIRIS: *"Overview of Recent Advances on Knot Segmentation in Tomographic Wood Images and Applications with Future Projects"*

- **Lama Tarsissi**, Université Paris Est Marne La Vallée: *"Inflation of digitally convex polyominoes"*

<div align="center">https://www.eko.polimi.it/index.php/TAIR/TAIR2019</div>

All the proceedings of presented events (expect the MTA meeting) were published in LNCS series:

| CTIC 19 | DGCI 19 | ISMM 19 | IWCIA 10 | RRPR 18 |

3 Plans until ICPR2020 and Beyond

3.1 New event including DGCI and ISMM

As detailed in the introduction the new event is planned to be organize in Uppsala.

3.2 Tutorial in Digital Geometry during ACPR 2019

A new tutorial on Digital Geometry has been accepted for presentation during the ACPR2019. It will take place on the first day of the conference: "Digital Geometry in Pattern Recognition: Extracting Geometric Features with DGtal and Applications". It will be presented by Bertrand Kerautret (Universitïẗé de Lyon 2, France) and Jacques-Olivier Lachaud (Université Savoie Mont-Blanc, France).

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`https://kerautret.github.io/ACPR19-DGPRTutorial`):

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3.3 Third Edition of RRPR Workshop

Following the second successful edition of the IAPR RRPR workshop, we plan to propose a third new edition of this workshop always in association to ICPR in order to promote Reproducible Research in Pattern Recognition. In particular, we plane to extend the short paper extension that was introduced in last edition.

Like previous edition we want add more impact to this workshop, we plane to anticipate contacts with ICPR chairs to orient the authors to this call for paper with the special TC18 focus. By this way, the ICPR authors will have the opportunity to submit their companion papers with a focus on the reproduction results.

3.4 Special Issue of IPOL on Discrete Geometry and Mathematical Morphology in link to RRPR

The announce of the special issue was announced during the two editions of DGCI and ISMM and we plane to select suitable papers during September and October.

3.5 Other Upcomming Events

Workshop ipaMAX. Also organized in conjunction with ACPR2019, a new workshop is proposed including discrete geometry in its topics (submission deadline 5 September): Image and Pattern Analysis for Multidisciplinary Computational Anatomy

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`http://www.media.imit.chiba-u.jp/ipaMAC2019/`

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Workshop IWCIA. The twentieth International Workshop on Combinatorial Image Analysis will be held on Novi Sad, Serbia, 16-18 July 2020. The first CfP is available here: `https://tc18.org/files/divers/callForPapersIWCIA20.pdf` with the workshop website:

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`https://iwcia2020.wordpress.com`

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3.6 Potential Organisation of a Summer School on Digital Geometry and Mathematical Morphology

As suggested during the ExCo meeting in Beiinjing, the organisation of a summer school on digital geometry and mathematical morphology could be a key point that naturally could be incited and supported by the TC18. Before to start such potential organisation, we have to answer to the following points:

- Researcher able and interested to organize such an event.

- Estimate the number of researcher/student that could be interested in the summer school.

- Associating the summer school with other TC or other event.