Final Report on IAPR-TC18 (October 2016 - June 2018)

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1 TC Brief background Information

1.1 Listing of TC Leadership Team

Chair: Bertrand Kerautret (Université de Lorraine, Nancy, France)

Vice Chair: Michael Wilkinson (Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence University of Groningen, The Netherlands)

Secretary: –

Board members :

- Arindam Biswas, Indian Institute of Engineering Science & Technology, Shibpur, India
- Andrea Frosini, Dept. Matematica and Informatica "Ulisse Dini", Firenze, Italia
- Georgios K Ouzounis, DigitalGlobe, Inc. Longmont, CO 80503, USA
- Hugues Talbot, Center for Numerical Vision, CentraleSupelec, France

Other appointments within the TC:

Chair of Reproducible Research Committee: Miguel Colom, CMLA, ENS Paris Saclay, Paris, France

Chair of Interface between MM & DG : Nicolas Passat, Université de Reims Champagne-Ardenne, CReSTIC, France

1.2 TC website URL

`http://tc18.org`

1.3 Number of members (people on mailing list)

The number of TC18 members continues to grow and, at present, it has **133** researchers (+**38 compared** to end of 2016). We expect that this number will continue to progressively increase since the membership invitation has been recently sent to the mailing lists collected from previous conferences (mainly ISMM 2017). We keep the membership list updated and we have removed a dozen of old members, mainly students, not active in DG or MM research domain any more.

As previously mentioned, the response of the MM community has been extremely positive and this constitutes a valuable resource to increase the dynamism of this TC.

1.4 Communication types used (e.g. newsletters) and frequency

The communication evolves into two main ways. A first one is based on the newsletters written about one or two per year depending of the events' calendar. In the last year, we received many requests to be spread like the call for papers or various announces. We choose to apply a direct diffusion in order to have more reactivity (rather than waiting the newsletter diffusion).

For instance, 19 announces were diffused from the last TC18 newsletter in August 2017. We also answer to the IAPR newsletter in April 2018 before the newsletter just sent in July 2018. (!!!i have not understood this phrase!!!)

1.5 Listing of key events usually organized by the TC

The two main events of the TC18 are naturally related to the two main domanis of Discrete Geometry with **DGCI** and Mathematical Morphology (ISMM). During the period 2016-2018 the following events were organized:

- 19th DGCI: 18-20 Apr. 2016 - Nantes (France)
- 13th ISMM: May 15-17, 2017 - Fontainebleau (France)
- 20th DGCI: 19-21 September. 2017 - Vienna (Austria)

2 Activities in the last two years (since ICPR 2016)

2.1 Mailing list and website refresh with updates

Update of diffusion system. A first action of the new board team was to update the previous mailing list: in particular for the members@tc18.org, it was a simple alias with a mail redirection pointing to all members' e-mails. Such a solution was not effective enough to filter non appropriate emails or spam whose number, according to some members, was extremely large. At present, the old address `members@tc18.org` is still active, but the mails are redirected to the address `tc18.members@inria.fr`. This new mailing list is handled by the *Sympa* mailing list server and is moderated with mail archives. We have transferred all members' e-mails from the previous alias and the system is ready to host new ISMM members.

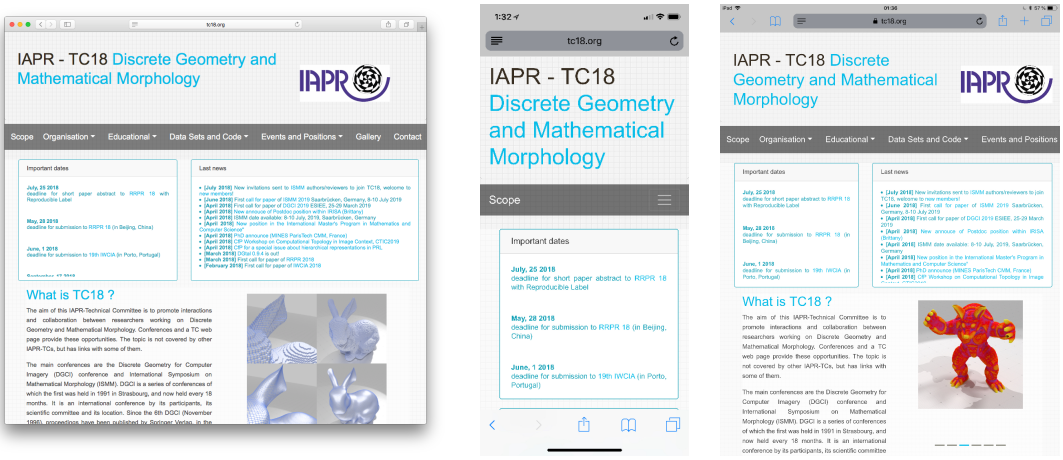
Thanks to this new *Sympa* mail diffusion system, we can also detect obsolete members, i.e., members whose e-mails are not active anymore. In this way, the maintenance of an updated mailing list is greately simplified. As a matter of fact, the mailing list was updated during July and all the 133 members are now error free. Another great advantage of this system is the possibility to create and access to a mail archives which can be always useful for the new members or to make a review on communication mode as already done in the previous section.

Even if the diffusion list is hosted by *INRIA*, its access can always be maintained by external non *INRIA* administrators.

Website structure refresh. The previous TC18 website was suffering of major problem due to a recent server update imposing us the use of a SSL connection associated to an invalid certificate. According to the web browser, users should have to add an exception if they want to access to the TC18 website, otherwise no access was allowed.

To solve this issue and apply the refresh to the website, we transferred the site content directly to the web host proposed by *GitHub*. Such a change implies major works since the previous structure was based on the PHP framework that does not allow the possibility to include a menu file and to write static page without the use of PHP. So, the main performed changes are the following:

- change DNS to point now on the *GitHub* host;
- move all PHP files to the *GitHub* web directories;
- change all PHP web pages into HTML and update the menu structure using the *Javascript* framework.
- include responsive features using *Bootstrap*;
- update the new contents and fix the presentation issue which were not responsive (list of members or events);
- fix the non-active links.



(a) computer (b) mobile phone (c) tablet devices

Figure 1: Illustration of the site rendering on different supports.

The main advantage of a direct web host is the fact that users can suggest new contributions and directly update them by proposing pull request. On each foot page, we add a link mentioning the *GitHub* hosting and a link allowing the user to read or edit directly the source page.

Among the other new features, we mention the fact that the new website is now responsive and suitable both for mobile devices as smartphone or tablets and for classical computers thanks to a dynamic layout adjustments. The figure 1 illustrates the new visualisation on the various devices.

Website content update The website received various continue updates from different sections in link to the inclusion of the new mathematical morphology axis. In particular, we perform the following changes:

- Update link in the section *Subfields and related lectures*: numerous links were no more available due URL changes.
- Gallery update: to illustrate results from the MM domain, new images were used from recent papers.
- List of demonstrations: contains now new online demonstration from MM related work.
- Update of the publications from DG and MM domains.
- New code added with works published from DGCI 2016.
- New content with tutorial content in section `http://tc18.org/educational.html#subfields_and_related_lectures`.

From the ISMM invitations, new help propositions were received with for instance: new data set proposed or help to maintain and construct automatic membership system with a given database.

2.2 Activities

2.2.1 Conferences and worskhops organized

During the period from July 2016 to June 2018, we organized the two main conferences of the domain DGCI and ISMM. In addition, other workshops were organized with IWCIA and more specific workshops like DGMM4CV and RRPR.

DGCI 2017 short report The 20th IAPR International Conference on Discrete Geometry for Computer Imagery, DGCI 2017, was held in Vienna, Austria, from 19 to 21 September 2017. This conference was organized by Walter G. Kropatsch, Nicole M. Artner and Ines Janusch from the Pattern Recognition and Image Processing Group at TU Wien, Austria.

The DGCI 2017 conference attracted 48 researchers. The scientific program consisted in 3 invited talks, 18 oral and 10 poster presentations during 3 days.

Three keynote speeches were given: - Helmut Pottmann (TU Wien, Austria): "Freeform Architecture and Discrete Differential Geometry". - Michael Wilkinson (University of Groningen, The Netherlands): "A guided tour of connective morphology" - Stephane Gaubert: Tropical and non-linear Perron-Frobenius methods for optimal control and zero-sum games

The full report is available online on the TC website:

`http://tc18.org/dgci/report_dgci2017.pdf`

ISMM short report From the previous TC18 letters, the 13th International Symposium on Mathematical Morphology held in Fontainebleau France, during May 15-17, 2017 (on the campus of MINES ParisTech). This symposium can be considered as the main scientific event in the field of Mathematical Morphology. They received around 53 high-quality papers each of which were reviewed by at least three reviewers. From the reviewing results 16 papers were accepted as poster presentation and 24 as oral presentation. The authors come from 15 different countries: Australia, Austria, Brazil, France, Germany, Greece, India, Japan, The Netherlands, Poland, Serbia, Sweden, Turkey, USA, and UK. Three keynote speakers were invited:

- Pierre Vandergheynst: Signal Processing on Graphs.
- Dan Ciresan: Deep Neural Networks for Biomedical Image Analysis.
- Stephane Gaubert: Tropical and non-linear Perron-Frobenius methods for optimal control and zero-sum games.

And a talk was given by Jean Serra for the 50 years of the CMM.

IWCIA short report The 18th international *Workshop on Combinatorial Image Analysis* (IWCIA 17) held in Plovdiv in Bulgaria, June 19-21, 2017. Five keynotes were given. The first one was a talk of Alfred Bruckstein on the *Probabilistic Ant Pursuits and Grid Geometry.* The second one was given by Marc van Kreveld with a presentation on *Onto the Grid and Off the Grid: on Measures and Picture Puzzles.* Then a talk on *Quantum Graphs, the Edge-based Laplacian and Shape* was given by Edwin Hancock followed by a talk of Christian Ronse on the *Orders on Partial Partitions for Image Segmentation, Filtering and Reduction.* And finally, Günter Rote presents a talk on *Congruence Testing in 4-Space.*

Other 27 presentations were given on the main topics of Digital Geometry and Topology, Computational and Combinatorial Geometry, Theory and Applications and Picture Grammars. A poster session on ongoing research projects and original works in progress were also proposed but not included in the conference proceedings.

A special issue on *Digital Manifolds in Computer Modeling* is associated to this event:

`https://www.journals.elsevier.com/information-sciences/call-for-papers/special-issue-on-digital-manifolds-in-computer-modeling`

DGMM4CV short report In conjunction of the main event of ACCV 2016, Akihiro Sugimoto, Yukiko Kenmochi and Jean Cousty proposed a new workshop which gather contributions including both discrete geometry and mathematical morphology contribution. The main topic of this workshop follows the new orientation of this TC18 with the inclusion of MM. This workshop held in Taipei, Taiwan the November 24, 2016:

http://www.dgcv.nii.ac.jp/DGMM4CV2016/

The program was composed of 7 oral talks including 3 invited speakers. All papers were published in the LNCS proceedings in the same volume than the ACCV main conference.

RRPR short report A new event was proposed with the first edition of the Workshop on Reproducible Research in Pattern Recognition. This workshop aims to give an overview of Reproducible Research (RR) for authors, with a special focus on Pattern Recognition algorithms. The call for paper was organized into two main tracks: RR Frameworks and RR Results. The first track was dedicated to the general topic of Reproducible Research in Computer Science with papers describing experiences, frameworks and platforms. The second track focus on the description of previous works in terms of Reproducible Research. The latter track contained ICPR companion papers describing their quality of Reproducible Research.

https://wrrpr2016.sciencesconf.org

This workshop received 16 submissions with 8 papers submitted to track 1 of RR Framework, 6 papers to track 2 of RR Results and 2 papers associated to the invited talks. After a reviewing process including mostly 3 reviewers per paper, 6 papers were accepted as oral presentations and 4 as poster. A total of 12 accepted papers (including 2 invited papers) are going to be published as post-proceedings Springer in LNCS series.

The different topics of workshop were equitably represented with 6 presentations for the RR Framework track and 5 presentations for the RR Result track. Two invited presentations were given during the workshop. The first one was a presentation of the Image Processing On Line journal (IPOL) presented by Pascal Monasse in a common work with Miguel Colom. The second invited talk was given by Daniel Lopresti and Bart Lamiroy with a presentation of the DAE platform in the context of Reproducible Research. The number of attendees were around thirty. For its first edition, the RRPR committee introduces the "Reproducible Label in Pattern Recognition" in order to highlight the reproducible aspects of the RRPR and ICPR works. The work of the authors who obtained the Reproducible label is archived and publicly available in the *GitHub* account of the organizing committee, https://github.com/RLPR.

Note that the second edition is organized on next August 2018.

https://rrpr2018.sciencesconf.org

2.2.2 Educational activities

ACCV 2016 Tutorial on Digital Geometry Processing The aim of this tutorial proposed by Bertrand Kerautret was to present the new robust geometric estimators (like normals, tangents, curvature and local noise estimators), recently proposed in the digital geometry community, starting from their theoretical description up to their concrete implementation in the emerging DGtal Library framework, and to show some of their applications. Such tutorial will benefit to the audience by showing them how to create image analysis tools using these features and how to integrate them in another framework like OpenCV.

This tutorial was presented during an half day session on November 20 before the ACCV 2016 main event:

https://kerautret.github.io/ACCV2016DGPTutorial/

ACCV 2016 Tutorial Content-Adaptive Morphological Filters Mathematical morphology filters using basic structuring elements (erosions, dilations etc) are classics. Most textbooks covering morphological filtering restrict their exposition to these basic filters. This is unfortunate, since very significant advances have been made since the development of these filters, in particular by making the filters adaptive to the image content. This has lead to a whole new range of image processing and analysis tools, ranging from shape preserving image denoising techniques, to

object recognition methods. In this tutorial we will discuss the theory behind recently developed advanced morphological filters, including adaptive structural filters, viscous filters, morphological PDEs, path openings, amoeba filters, and connected, semi-connected and hyperconnected filters. Numerous applications will be used to demonstrate the usefulness of these filters. This tutorial is the second in a series, the first having been presented at ICPR 2014 in Stockholm. The present proposal is updated with new results and applications that have recently appeared.

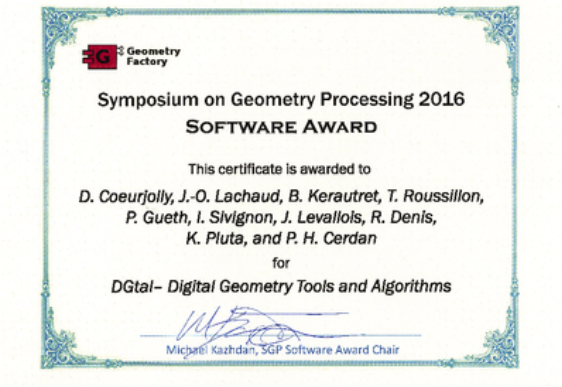
`http://www.cs.rug.nl/~michael/ACCV2016-MM-Tutorial/`

ICPR 2016 Tutorial on Graph-based Mathematical Morphology This tutorial was proposed by Laurent Najman and Hugues Talbot and it aims at disseminating graph-based ideas stemming from the mathematical morphology community to the interested public of ICPR attendees. It follows the line of the paper "A graph-based mathematical morphology reader". It also aims at an audience consisting of practitioners and theoreticians. Practitioners will find here an up-to-date panel of graph-based morphological tools with examples and applications. Theoreticians will find ideas on how these tools are related to other computer vision and image analysis frameworks.

`http://www.icpr2016.org/site/session/`
`a-tutorial-on-graph-based-mathematical-morphology`

2.2.3 Promotion of Research

The different initiatives like the work on the *DGtal* Library allow to promote research results. It was recognized in other communities like in geometry processing with the SGP Software award in 2016 (`http://awards.geometryprocessing.org`.



In the same way, the online demonstrations of the IPOL papers allow to promote research results from a direct way:

`http://tc18.org/demos.html`

Associated to main conferences of DGCI, ISMM and IWCIA, several special issues in major journals were proposed:

- **JMIV Special issue** on Special Issue on Discrete Geometry for Computer Imagery: (published in 2017 Volume 59, Number 1, September 2017, 1), see details: `http://tc18.org/files/2017-Papers.txt`
- **Discrete Applied Mathematics Special issue** Valentin Brimkov & Reneta Barneva proposed a special issue on Graph-theoretic and Polyhedral Combinatorics Issues and Approaches in Imaging Sciences
- **JMIV Special issue** on Special Issue on Discrete Geometry for Computer Imagery (2018).

2.2.4 Publicity / dissemination activities

A new TC18 team was created on *GihHub* that aims at create more visibility and receive a direct feedback with code repository appearing in the domain of discrete geometry and mathematical morphology:

`https://github.com/TC-18`

Moreover as usual a presentation of the TC was performed at each main event of DGCI with a short presentation. The presentation of the DGCI is given here: `http://tc18.org/files/reportDGCI2017.pdf`. Similarly a TC18 presentation was given by Michael Wilkinson at ISMM 2017.

2.2.5 Links with other organizations and TCs

This TC has some links to local french organisation that allows to share various communications. Nicolas Passat has the role to make relation between these two organisations.

Members of this TC18 proposed a special session on "Recent advances on hierarchical image representations for the processing and the analysis of complex imaging data" which has links to TC15 on graph based representation.

3 Future plans (timeline until ICPR 2020 and beyond):

3.1 Dissemination plans

For the next term, we plane to continue the efforts made to gather activities from DG and MM field. For this purpose a new tentative to propose a common event between DGCI and ISMM will be studied before the new editions of DGCI and ISMM 2019. Such type of common event appears important in order to unify these fields and win in visibility.

New special issues are planned to applied mainly from the work of this resulting conferences. In particular since DGCI and ISMM will be separated from only 4 months it could be interesting to propose a special session in a common journal with contribution given from the two fields. For instance a special session with IPOL could be a possibility in addition to other special issues.

3.2 Planned activities

Common DG & MM satellite workshop Depending of the success of the organisation of a common event, an alternative will be to propose a new edition of the DGMM4CV workshop in conjunction to a major conference like in a computer vision conference.

Reproducible Reproducible Focus In the field of the reproducible research, the second edition of the RRPR workshop is already programmed which includes a special focus on DG and MM. The post proceedings edition accepted by Springer as ICPR separated proceedings will allow to add more revised papers resulting of the workshop presentations and discussions.

Tutorials Proposing new tutorial related to DG and MM are also on the future plan of this TC. That could be important to propose it in various types of conferences.

3.3 Recommendation to ExCo for TC leadership team for 2018-2020 term

For the next term, we plane to continue on the same base with the same organisation with the following identified responsibilities.

1. **Leadership**: Proposed leadership responsibilities for 2018-2019:

- **Chair:** Bertrand Kerautret (Université de Lyon 2, France)
- **Vice-Chair:** Michael Wilkinson (Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence University of Groningen The Netherlands)
- **Secretary:** Phuc Ngo (LORIA, Université de Lorraine, France)
- **Advisors:** Hugues Talbot (Center for Numerical Vision, CentraleSupelec, France)

2. **Committee**:

- **Conference Committee**:Andrea Frosini Dept. Matematica and Informatica "Ulisse Dini", Firenze, Italia
- **Education Committee**: Arindam Biswas (IIEST, Indian Institute of Engineering Science and Technology, Shibpur, India)
- **Awards Committee:** already handled by the steering committee of DGCI.
- **Industry Liaison Committee:** Georgios K Ouzounis DigitalGlobe, Inc. Longmont, CO 80503, USA
- **Reproducible Research Committee:** Miguel Colom, CMLA, ENS Paris Saclay, Paris, France
- **Interface between MM & DG and national workgroups**: Nicolas Passat - Université de Reims Champagne-Ardenne, CReSTIC, France