

Raphaël MARÉE

Contact

Systems and Modeling
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Education

Sept. 1996 - Jul. 2000

Master in Computer Science, University of Liège, Belgium.
Final Project (in french): “Conception d’une plate-forme de Data Mining distribuée” (“Development of a distributed data mining platform using CORBA”). Supervisor: Prof. Louis Wehenkel.

Oct. 2000 - Feb. 2005

PhD in Computer Science, University of Liège, Belgium.
Thesis title (in french): “Classification automatique d’images par arbres de décision” (“Automatic Image Classification using Decision Trees”).
Supervisor: Prof. Louis Wehenkel.

Professional experiences

2000-2005

PhD research in Machine Learning and Computer Vision
University of Liège, Montefiore Institute.

2005-2014

Management of the GIGA Bioinformatics core facility
University of Liège, GIGA technology platforms.

2014-2015

One year postdoc at Pasteur Institute
Unité d’analyse d’images biologiques, Paris, France.

Current position:

2010-... Researcher and Scientific coordinator of the CYTOMINE research project
University of Liège, Montefiore Institute and GIGA research center.

Professional activities

Research and Development Experience:

- Design of novel generic algorithms and softwares using machine learning for large-scale image classification, content-based image retrieval, and semantic segmentation (2002-...). Biomedical applications in the context of various diseases and biological processes.
- Analysis services for biomedical researchers (incl. on imaging data, high throughput proteomic mass-spectrometry data, clinical data) (2005-2014) related to various diseases and biological processes.
- Coordination of bioinformatics activities and infrastructure (high-performance computing cluster and mass storage) (2005-2014).

Organisation of scientific meetings:

- 1st Computational Pathology workshop at ECCB (The Hague, September 2016)
- 14th International Congress for Stereology and Image Analysis (Liège, July 2015)
- 17th Benelux annual meeting on machine learning (Spa, May 2008)

Scientific work evaluation:

- Program committee memberships: 1st Computational Pathology workshop at ECCB (The Hague, September 2016), 14th International Congress for Stereology and Image Analysis (Liège, July 2015), Benelearn (Spa, May 2008), ICML-UAI-COLT 2009 Workshop on Automated Interpretation and Modeling of Cell Images.
- Reviewer for international journals: IEEE Pattern Analysis and Machine Intelligence, Bioinformatics, IEEE Transactions on Biomedical Engineering, IEEE Signal Processing Magazine, BMC Bioinformatics, Medical Image Analysis, Journal of Microscopy, ...
- Reviewer for international conferences: ISBI 2015-2017, IJCAI 2009, ECCB 2008, ECML-PKDD, ISVC, SGAI, ...
- Reviewer for European Research Council grants (2014).

Supervision:

- Since 2002, (co-)supervision of about 25 MSc final projects about applications of machine learning algorithms to various problems in bioimage informatics, computer vision, and bioinformatics.
- Since 2010, scientific coordination of an interdisciplinary project involving computer scientists, researchers in biomedical sciences and anatomopathologists from 2 belgian universities (<http://www.cytomine.be/>).

Research Valorization:

- Cytomine open-source software for multi-gigapixel collaborative analysis (<http://www.cytomine.be/>).
- PEPITe co-founder and collaborator (spin-off company specialized in knowledge extraction techniques for industrial processes). Transfer of image classification algorithms (2005).

- Development of BestCyte Cell Sorter, project with CellSolutions LLC (<http://www.cellsols.com/>, USA) on cytology image analysis.
- Data analysis studies for international private companies through the GIGA Bioinformatics Core Facility.

Training support:

- Organization assistance for GIGA/Forem training on “Introduction to bioinformatics” and “Data analysis for bioinformatics” (2007, 2009).

Selected publications

This selection includes a subset of peer-reviewed papers.

All publications (complete list) can be downloaded individually here:

<http://www.montefiore.ulg.ac.be/~maree/#publications>. Related citations are here: <http://scholar.google.be/citations?user=qG66mF8AAAAJ&hl=en>.

PhD thesis:

- “*Classification automatique d’images par arbres de décision*”. Department of Electrical Engineering and Computer Science, University of Liège, Belgium, February 2005. (143 pages).

Invited book chapter:

- “*Extremely randomized trees and random subwindows for image classification, annotation, and retrieval*”. **Raphaël Marée**, Louis Wehenkel, Pierre Geurts. In Book “Decision Forests for Computer Vision and Medical Image Analysis”, Eds. A. Criminisi, J. Shotton, and E. Konukoglu. Springer, Advances in Computer Vision and Pattern Recognition series, pp. 125-141, 2013.

Journal papers:

- Methodological works in machine learning and bioimage informatics
 - “*Towards Generic Image Classification using Tree-based Learning: an Extensive Empirical Study*”. **Raphaël Marée**, Pierre Geurts, and Louis Wehenkel. Pattern Recognition Letters, DOI: 10.1016/j.patrec.2016.01.006, 2016.
 - “*Collaborative analysis of multi-gigapixel images using Cytomine*”. **Raphaël Marée**, Loïc Rollus, Benjamin Stévens, Renaud Hoyoux, Gilles Louppe, Rémy Vandaele, Jean-Michel Begon, Philipp Kainz, Pierre Geurts, and Louis Wehenkel. Bioinformatics, 2016. DOI: 10.1093/bioinformatics/btw013, 2016.
 - “*Phenotype Classification of Zebrafish Embryos by Supervised Learning*”. Nathalie Jeanray, **Raphaël Marée**, Benoist Pruvost, Olivier Stern, Pierre Geurts, Louis Wehenkel, Marc Muller. PLoS One. 2015 Jan 9;10(1).

- “*Evaluation and Comparison of Anatomical Landmark Detection Methods for Cephalometric X-Ray Images: A Grand Challenge*”. Cheng-Ta Huang, Meng-Che Hsieh, Chung-Hsing Li, Sheng-Wei Chang, Wei-Cheng Li, Rémy Vandaele, **Raphaël Marée**, Sébastien Jodogne, Pierre Geurts, Cheng Chen, Guoyan Zheng, Chengwen Chu, Hengameh Mirzaalian, Ghassan Hamarneh, Tomaz Vrtovec and Bulat Ibragimov. *IEEE Transactions on Medical Imaging*, **34**(9):1890-1900, 2015.
- “*A rich internet application for remote visualization and collaborative annotation of digital slide images in histology and cytology*”. **Raphaël Marée**, Benjamin Stevens, Loïc Rollus, Natacha Rocks, Xavier Moles-Lopez, Isabelle Salmon, Didier Cataldo, Louis Wehenkel. *BMC Diagnostic Pathology*, Vol. 8 (Suppl. 1): S26, 2013.
- “*Automated processing of zebrafish imaging data - a survey*”. Ralf Mikut, Thomas Dickmeis, Wolfgang Driever, Pierre Geurts, Fred Hamprecht, Bernhard X. Kausler, María J Ledesma-Carbayo, **Raphaël Marée**, Karol Mikula, Periklis Pantazis, Olaf Ronneberger, Andres Santos, Rainer Stotzka, Uwe Strähle, Nadine Peyriéras. *Zebrafish*, 10:3, 2013.
- “*Content-based Image Retrieval by Indexing Random Subwindows with Randomized Trees*”. **Raphaël Marée**, Pierre Geurts, Louis Wehenkel. *IPSJ Transactions on Computer Vision and Applications* (open-access), Volume 1, Number 1, page 46-57 - jan 2009
- “*Random Subwindows and Extremely Randomized Trees for Image Classification in Cell Biology*” **Raphaël Marée**, Pierre Geurts, Louis Wehenkel. *BMC Cell Biology*, supplement on Workshop of Multiscale Biological Imaging, Data Mining and Informatics, Volume 8, Number S1, 2007.
- Image analysis applications in biology/biomedecine
 - “*Evaluation of BRCA1-related molecular features and microRNAs as prognostic factors for triple negative breast cancers*”. Meriem Boukerroucha, Claire Josse, Sonia El-Guendi, Bouchra Boujemla, Pierre Freres, **Raphaël Marée**, Stephane Wenric, Karin Segers, Joelle Collignon, Guy Jerusalem and Vincent Bours. *BMC Cancer*, **15**(755), 2015.
 - “*The timing of surgery after neoadjuvant radiotherapy influences tumor dissemination in a preclinical model*”. N. Leroi, NE. Sounni, E. Van Overmeire, S. Blacher, **Raphaël Marée**, JA. Van Ginderachter, F. Lallemand, E. Lenaerts, PA. Coucke, A. Noel, Ph. Martinive. *Oncotarget*. 2015 Nov 3;6(34):36825-37.
 - “*Zebrafish bone and general physiology are differently affected by hormones or changes in gravity*”. Jessica Aceto, Rasoul Nourizadeh-Lillabadi, **Raphaël Marée**, Nathalie Jeanray, Louis Wehenkel, Peter Alestrom, Jack van Loon, Marc Muller. *PLoS ONE* 10(6): e0126928, 2015.
 - “*Activation of the calcium-sensing receptor before renal ischemia / reperfusion exacerbates kidney injury*”. WEEKERS Laurent, De Tullio Pascal, BOVY Christophe, Poma Laurence, **Raphaël Marée**, BONVOISIN Catherine, Defraigne Jean-

- Olivier, Krzesinski Jean-Marie, Jouret François. American Journal of Translational Research 7 128-135, 2015.
- “*Evaluation of CellSolutions’ BestPrep Automated Thin-Layer Liquid Based Cytology Pap Slide Preparation and BestCyte Cell Sorter Imaging System*”. Agnès Delga, Frédéric Goffin, Frédéric Kridelka, **Raphaël Marée**, Chantal Lambert, Philippe Delvenne . Acta Cytologica, Vol. 58, No. 5, 469-477, 2014.
 - “*P2X1 ion channels promote neutrophil chemotaxis through Rho kinase activation*” Christelle Lecut, Kim Frederix, D.M. Johnson, C. Deroanne, M. Thiry, C. Faccinnetto, N. Ruzicka, **Raphaël Marée**, R.J. Evans, P. Volders, Vincent Bours, Cécile Oury. Journal of Immunology, Aug 15;183(4):2801-9, 2009.
 - Proteomic/Genomic data analysis
 - “*Identification of protein biomarkers associated with cardiac ischemia by a proteomic approach*” . M. Fillet, C. Deroyer, G. Cobraiville, C. Le Goff, E. Cavalier, J. P. Chapelle, **Raphaël Marée**, V. Legrand, L. Pierard, Ph. Kohl, and M.-P. Merville, Biomarkers, Vol. 18, No. 7, Pages 614-624, 2013.
 - “*Structural Determinants of Specificity and Catalytic Mechanism in mammalian 25-kDa Thiamine Triphosphatase*” . David Delvaux, Frédéric Kerff, Mamidanna R.V.S. Murty, Bernard Lakaye, Jan Czerniecki, Grégory Kohn, Pierre Wins, Raphaël Herman, Valérie Gabelica, Fabien Heuze, X. Tordoir, **Raphaël Marée**, André Matagne, Paulette Charlier, Edwin De Pauw, Lucien Bettendorff. Biochimica et Biophysica Acta - General Subjects, 1830(10), 2013.
 - “*Discovery and biochemical characterisation of four novel biomarkers for osteoarthritis*” . Dominique deSeny, Mohammed Sharif, Marianne Fillet, Gaël Cobraiville, Marie-Alice Meuwis, **Raphaël Marée**, Jean-Philippe Hauzeur, Louis Wehenkel, Edouard Louis, Marie-Paule Merville, John Kirwan, Clio Ribbens, Michel Malaise. Annals of the Rheumatic Diseases, 2011
 - “*Biomarker discovery in asthma-related inflammation and remodeling*” . Florence Quesada Calvo, Marianne Fillet, Dominique deSeny, Marie-Alice Meuwis, **Raphaël Marée**, Celine Crahay, Genevieve Paulissen, Natacha Rocks, Maud Gueders, Louis Wehenkel, Marie-Paule Merville, Renaud Louis, Jean-Michel Foidart, Agnès Noel, Didier Cataldo. Proteomics, Volume 9, Number 8, page 2163-2170, 2009.
 - “*Predetector: a new tool to identify regulatory elements in bacterial genomes*” Samuel Hiard, **Raphaël Marée**, Séverine Colson, Paul A. Hoskinson, Fritz Titgemeyer, Gilles P. van Weeze, Bernard Joris, Louis Wehenkel, Sébastien Rigali. Biochemical and Biophysical Research Communications, Volume 357, Number 4, page 861-864, 2007.

Journal papers in french:

- “*Une méthode générique pour la classification automatique d’images à partir des pixels*”. **Raphaël Marée**, Pierre Geurts, and Louis

Wehenkel. *Revue des Nouvelles Technologies de l'Information*, Numéro spécial Entreposage et Fouille de données, 1:227-238, June 2003. (12 pages).

- “*Un compilateur d'expressions mathématiques générant du MathML*”. Benjamin JENNES and **Raphaël MARÉE**. In Cahiers GUTenberg, 33-34, December 1999. (Invited paper; 7 pages).

Conference papers (peer-reviewed):

- “*Automated multimodal volume registration based on supervised 3D anatomical landmark detection*”. Rémy Vandaele, François Lallemand, Philippe Martinive, Akos Gulyban, Sébastien Jodogne, Philippe Coucke, Pierre Geurts, **Raphaël Marée**, Proc. 12th International Conference on Computer Vision Theory and Applications, 2017. (8 pages).
- “*An approach for detection of glomeruli in multisite digital pathology*”. **Raphaël Marée**, Stéphane Dallongeville, Jean-Christophe Olivo-Marin, Vannary Meas-Yedid. Proc. IEEE International Symposium on Biomedical Imaging, 2016. (4 pages).
- “*Détection automatique de glomérules en pathologie digitale*”. **Raphaël Marée**, Jean-Christophe Olivo-Marin, Vannary Meas-Yedid. GRETSI 2015. (4 pages).
- “*A hybrid human-computer approach for large-scale image-based measurements using web services and machine learning*”. **Raphaël Marée**, Loïc Rollus, Benjamin Stevens, Gilles Louppe, Olivier Caubo, Natacha Rocks, Sandrine Bekaert, Didier Cataldo, Louis Wehenkel. Proc. IEEE International Symposium on Biomedical Imaging, 2014. (5 pages).
- “*Automatic localization of interest points in zebrafish images with tree-based methods*”. Olivier Stern, **Raphaël Marée**, Jessica Aceto, Nathalie Jeanray, Marc Muller, Louis Wehenkel, Pierre Geurts. Proc. 6th International Conference on Pattern Recognition in Bioinformatics, 2011. (12 pages).
- “*Incremental Indexing and Distributed Image Search using Shared Randomized Vocabularies*”. **Raphaël Marée**, Philippe Denis, Louis Wehenkel, Pierre Geurts. Proc. 11th ACM International Conference on Multimedia Information Retrieval (MIR), 2010. (10 pages)
- “*A Machine Learning Approach for Material Detection in Hyperspectral Images*” **Raphaël Marée**, Benjamin Stevens, Pierre Geurts, Yves Guern, Philippe Mack. Proc. 6th IEEE Workshop on Object Tracking and Classification Beyond and in the Visible Spectrum at CVPR, 2009. (6 pages)
- “*Fast Multi-Class Image Annotation with Random Subwindows and Multiple Output Randomized Trees*” Marie Dumont, **Raphaël Marée**, Louis Wehenkel, Pierre Geurts Proc. International Conference on Computer Vision Theory and Applications (VISAPP), Volume 2, page 196-203, 2009. (8 pages).
- “*Segment and combine: a generic approach for supervised learning of invariant classifiers from topologically structured data*”. Pierre Geurts, **Raphaël Marée**, Louis Wehenkel. Machine Learning

Conference of Belgium and The Netherlands (Benelearn) - 2006. (9 pages).

- “*Reinforcement learning with raw image pixels as input state*”. Damien Ernst, **Raphaël Marée**, Louis Wehenkel. International Workshop on Intelligent Computing in Pattern Analysis/Synthesis (IWICPAS), 2006. (9 pages).
- “*Random Subwindows for Robust Image Classification*”. **Raphaël Marée**, Pierre Geurts, Justus Piater, Louis Wehenkel. In Proceedings of the IEEE International Conference on Computer Vision and Pattern Recognition (CVPR 2005), Volume 1, page 34–40, June 2005, San Diego, USA. (7 pages).
- “*A generic approach for image classification based on decision tree ensembles and local sub-windows*”. **Raphaël Marée**, Pierre Geurts, Justus Piater, Louis Wehenkel. In Proceedings of the 6th Asian Conference on Computer Vision (ACCV 2004), Volume 2, page 860-865, January 2004, Jeju, Korea. (6 pages).
- “*A Comparison of Generic Machine Learning Algorithms for Image Classification*”. **Raphaël Marée**, Pierre Geurts, Giorgio Visimberga, Justus Piater, Louis Wehenkel. In Proceedings of AI-2003 (23rd SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence), December 2003, Cambridge, United Kingdom. (6 pages).

Abstracts:

- Abstracts or Extended Abstracts accepted at various conferences or workshops: European Conference on Digital Pathology (2014,2016), Benelux Bioinformatics Conference (2013), Conference on Pattern Recognition in Bioinformatics (PRIB 2011), BioImage Informatics Conference (2006, 2009, 2011, 2012, 2014), Machine Learning conference of Belgium and The Netherlands (Benelearn 2011,2016), Workshop on Microscopic Image Analysis with Applications in Biology (2011), International Conference on Intelligent Systems for Molecular Biology (2007), ...

Oral presentations (selected or invited)

- Workshop “Bioinformatics meets digital pathology” at ECCB, 3th September 2016, Den Hague, The Netherlands.
- Seminar at Image and Signal Processing Group, UCL, Louvain-La-Neuve, Belgium, 9th June 2016. **(Invited)**
- 13th European Congress on Digital Pathology (ECDP 2016), 25-28th May 2016, Berlin, Germany.
- AIDPATH workshop, 25th April 2016, Kortrijk, Belgium. **(Invited)**
- International Symposium on Biomedical Imaging (ISBI’16), 13-16th April 2016, Prague, Czech Republic.

- Med-e-Tel (International eHealth, Telemedicine and Health ICT forum), 6th April 2016, Luxembourg.
- Journée CNRS Traitement d'images en Microscopie, December 15th, UPMC, Paris, France.
- GDR MIV "Bioimage Informatics - Computational Phenotyping", Pasteur Institute, 24th November 2015. **(Invited)**
- Digital Pathology Asia, Kuala Lumpur, September 22th 2015. **(Invited)**
- 14th International Congress for Stereology and Image Analysis, 9th July 2015
- GdR ISIS, Université Paris-Descartes (Paris 5), Paris, June 23rd 2015.
- European BioImage Analysis Symposium, Institut Curie, Paris, January 6th 2015.
- AIReWAY II IUAP scientific annual meeting, Liège, June 13th, 2014. **(Invited)**
- Cours Couleur, La Cambre, Brussels, May, 6th and 8th, 2014. **(Invited)**
- VIB Department of Plant Systems Biology, Ghent, February 14th, 2014. **(Invited)**
- Workshop Microscopie virtuelle, Ecole des Mines, Paris, February 5th, 2014
- Benelux Bioinformatics Conference, Brussels, 9th December 2013 **(Oral presentation prize winner)**
- Big Data workshop, UniGR, Luxembourg City, December 6th, 2013
- 3rd European Conference on Whole Slide Imaging and Analysis, Heidelberg, November 29 - 30, 2013
- Master Class Life Sciences Innovative Imaging of brain, body, and beyond, Hasselt University (Bioville), October, 16th, 2013 **(Invited)**
- Centre Ingenierie Biomedicale (LISA - Laboratories of Image, Signal processing and Acoustics), ULB, Brussels, October, 29th, 2013 **(Invited)**
- BioImage Informatics, Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany, 18th September 2012
- 12th European Congress on Telepathology and 5th International Congress on Virtual Microscopy, Venice, Italy, 8th June 2012
- 2nd European Zebrafish PI Meeting, Karlsruhe Institute of Technology, Germany, 23rd March 2012
- International Conference on Multimedia Information Retrieval, Philadelphia, USA, 30th March 2010.

- IME Fraunhofer Institute, RWTH University, Aachen, 27th October 2009. **(Invited)**
- International Conference on Computer Vision Theory and Applications, Lisbon, Portugal, February 2009.
- Laboratoire d'Informatique de Paris 6, 14th May 2008.
- Asian Conference on Computer Vision, Tokyo, Japan, 22nd November 2007.
- Workshop on Multiscale Biological Imaging, Data Mining Informatics, UCSB, Santa Barbara, USA, 8th September 2006.
- Workshop on Intelligent Computing in Pattern Analysis/Synthesis, Xi'an, China, 27th August 2006.
- Workshop on Machine Learning Techniques for Processing Multimedia Content, Bonn, Germany, 11th August 2005.
- International Conference on Computer Vision and Pattern Recognition, San Diego, USA, June 2005.
- 4th GIGA (Interdisciplinary Cluster of Applied Geno-proteomics) Day, Montefiore Institute, University of Liège, 25th March 2004.
- 23rd SGAI International Conference, Cambridge, 16th december 2003.
- Journée de statistiques, Lyon, France, June 2003.

Scientific awards, grants, and memberships

Member of the Management Committee (Belgium) for COST Action NEUBIAS: "A new Network of European BioImage Analysts to advance life science imaging", 2015-2019.

BRAIN-be pioneer grant (with P.-Y. Desai, MRBAB) from Belspo, 2015-2017.

Germaine Tillion research project grant (with Prof. D. Verpoorten, ..., ULg) from "Wallonie", 2014-2017.

Mission scientifique (MIS) grant (ULg), 2014-2015.

Oral presentation prize winner, Benelux Bioinformatics Conference, 2013.

WIST3 research project grant (with Prof. Wehenkel, ..., ULg) from "Wallonie", 2010-2016.

"Bourse Standard de Liège" from "Fonds Léon Frédéricq", 2005-2007.

"FIRST-Doctorat" grant from "Wallonie", 2000-2004.

Fernand Pisard grant, University of Liège, 1998-2000.

FNRS travel grants to participate to several conferences, 2005-....

Notable performances at scientific challenges:

- Second position at ISBI Automatic Cephalometric X-Ray Landmark Detection Challenge 2014 (with Remy Vandaele)
- Fourth position at 2nd International Competition on Cells Classification by Fluorescent Image Analysis (ICIP 2013)
- Fourth position at the ImageCLEF Medical Automatic Image Annotation Task, 2005.

Abroad stay and scientific events

From 10/13/2014 to 10/12/2015 (12 months), Pasteur Institute, Paris, France. Data mining and image analysis methods for the discovery of clinically significant histological patterns: applications in nephrology.

From 09/19/2009 to 10/19/2009 (1 month), IME Fraunhofer Institute, RWTH Aachen. Evaluation of image classification techniques in the context of protein crystallization studies.

From 09/26/2005 to 09/30/2005 (1 week), participation to an advanced introductory course on modern biology, Genopole, Evry, France.

Since 2003, participation to several international conferences in computer vision, machine learning, data mining, and bioinformatics (cf. presentation list).

Collaborations

Here is a glimpse of my collaborations, see the publication list and valorization for other collaborative projects.

Within University of Liège and externals

- Dr. Vannary Meas-Yedid, Unité d'analyse d'images biologiques, Pasteur Institute (since 2014).
- Dr. Philipp Kainz, Medical University Graz (since 2014).
- Prof. Dr. Isabelle Salmon, Department of Pathology, Erasme University Hospital, Université Libre de Bruxelles (since 2010).
- Several groups at the GIGA (and their international partners) on “biomedical image analysis”: Laboratory of Tumor and Development Biology, Laboratory of Anatomical Pathology, Laboratory of Molecular Biology and Genetic Engineering, Laboratory of Human Genetics, Laboratory of Virology and Immunology (since 2005).
- Several groups at the GIGA (and their international partners) on “identification of potential biomarkers from proteomic data”: Laboratory of medical chemistry, Laboratory of Tumor and Development Biology (2005-2013).
- Dr. Johannes Levels, Academic Medical Center, Amsterdam, “Analysis of SELDI-TOF mass spectrometry time-series data of HDL patients” (2007-2011).
- ... See papers for more details ...