Maxime Bombrun, PhD

Data Scientist

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Experience

Projects

2018–Present

Data Scientist, *Data Analytics Team, Forest Industry Informatics, Scion*, Rotorua, New Zealand.

I am developing mathematical models for phenotyping inferences. A large dataset of features have been agglomerate ranging from topography, lidar measurements, silvicultural, climatic data, and genetic information, containing more than one billion observations of the forest. These inferences allow to estimate and predict the productivity of trees across the estate, and therefore, select tree stocks based on environmental conditions for superior genotyping.

2015–2018

PostDoc, *Centre for Image Analysis and SciLifeLab, Uppsala Universitet*, Uppsala, Sweden.

Principal Investigator: Prof. Carolina Wählby (Centre for Image Analysis and SciLifeLab)
Large-Scale Data Analysis for Digital Image Analysis Applications

In this project, I developed the foundation of a tool for automated quantification of cell and tissue morphology in digital images. Difficulties lie in the management and processing of more than 20 images of more than two giga-pixels in size. This framework aims to support clinicians' diagnosis and to complement visual assessment when investigating disease and/or drug response.

- I developed an open-source tool which combine the analysis of gene expression with quantification of cell and tissue morphology.
- I was in charge of a web platform for visualisation of large slide scanner images (e.g., 48000×40000 pixels) at different resolutions.
- As an additional project, I developed an image processing algorithm for nucleus and lipid droplet segmentation and feature extraction in high-content/high-throughput microscopy screening.

2012–2015

PhD Student, *Université Blaise Pascal*, Clermont-Ferrand, France.

Supervisors: Prof. Andrew Harris (Laboratoire Magmas et Volcans (LMV)) and Prof. Vincent Barra (Laboratoire Informatique, Modélisation et Optimisation des Systèmes (LIMOS))
Characterisation of Volcanic Emissions through Thermal Vision.

My thesis studies concentrated on the different components of strombolian eruptions at the full range of remote sensing spatial scales. These range from millimeters (83,000 individual particles detected through 31 eruptions recorded at 200Hz with thermal camera) to kilometers (two frames per day over two years, imaged with satellite field of view). Overall, I aimed to provide a better understanding of plume dynamics through thermal vision.

- I developed an algorithm to segment and track high-speed particles recorded on thermal videos.
- I designed a novel method to segment and parameterise volcanic plumes on thermal videos.
- I developed an algorithm to detect multiple change points in 2D radiometer data.
- I worked on a new process to detect hot spots in satellite imagery.

2012
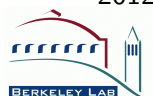
Intern, *Lawrence Berkeley National Laboratory (LBNL)*, Berkeley, USA, 6-month internship.

Supervisors: Dr. Sylvain Costes (LBNL), Dr. Davil Hill (LIMOS)
Java applications development for Detection and Tracking of DNA repair centers

The aim of this project was to improve the understanding of the nucleid organisation and the spatial distribution of the DNA repair center. I developed and optimized algorithms to segment, track and register nucleid through time in high-content screening.

Teaching

2017	**Speaker**, *Advanced Methods in BioMedical Image Analysis*, Brno, Czech Republic.
	Summer School: Image Analysis in Biomedical Screening Application (lectures and tutorials) *4h*
2016	**Speaker**, *Congress of the Internat. Society for Advancement of Cytometry*, Seattle, USA.
	Scientific tutorial: Configuring accurate cell detection in images using CellProfiler *4h*
2015–2017	**Lecturer**, *Uppsala Universitet/Karolinska Institutet*, Uppsala/Stockholm, Sweden.
	Teaching Master and PhD students: Bioimaging and Cell Analysis, Image Analysis & Processing, CellProfiler (responsible of the content for lectures and tutorials) *34h/year*
2013–2015	**Teaching Assistant**, *Université Blaise Pascal*, Clermont-Ferrand, France.
	Teaching Master students in engineering school: Data structure (lectures and tutorials) *56h/year*

Education & Diplomas

2012–2015	**Doctorate**, *LMV/LIMOS*, *Université Blaise Pascal*.
	Characterisation of Volcanic Emissions through Thermal Vision
2011–2012	**Master's Degree**, *Université Blaise Pascal*, *Master's Degree in Image Processing*.
2009–2012	**Master's Degree**, *Institut Supérieur d'Informatique, de Modélisation et de leurs Applications (ISIMA)*, *Master's Degree in Engineering (i.e., Diplôme d'ingénieur), specializing in Computation and Scientific Modelling (Applied Mathematics)*.

Languages

French	Native speaker	
English	Fluent, working language	*IELTS(2018), score 6.5/9; TOEFL(2015), score 103/120* *Experience: 6-month internship in California, 2-year postdoc in Uppsala, collaborations with English speaking colleagues*
Swedish	Competent	*Experience: 2-year postdoc in Uppsala, Sweden*
German	Basic	
Japanese	Basic	

Key Skills

Image Science	Geo- and Bio-Image Analysis, Infrared Imaging, Giga-pixel Images, Segmentation, Pattern Recognition & Tracking, Remote Sensing, Visualisation
Data Analysis	**Machine Learning**, High-Throughput/High-Content, Classification, **Big Data**, SQL/sqlite/Oracle, Dimensionality Reduction
IT	C/C++/CImg, **Python/OpenCV**/Keras/TensorFlow, Java/ImageJ, **Matlab, R**, Objective-C, JavaScript, PHP, Parallel Computing, Unix/Windows/Mac
Modelling	Partial differential equations, Solids and fluids mechanics, CATIA, UML
Industry-specific	Linear programming, Optimization, Operations Research, Graph theory
Other	Office suite, LaTeX

References

Image Processing
- Prof. Vincent Barra
- Dr. Sylvain Costes
- Prof. Andrew Harris
- Prof. Carolina Wählby

Journal Reviewer

Geology	Geochemistry, Geophysics, Geosystems Journal of Geophysical Research
Biology	Medical Image Analysis Transactions on Medical Imaging
Informatics	Scientific Reports - Nature ISBI 2018

Journal Articles

Maxime Bombrun, Hui Gao, Petter Ranefall, Niklas Mejhert, Peter Arner, and Carolina Wählby. Quantitative high-content/high-throughput microscopy analysis of subject-specific adipogenesis models. *Cytometry Part A*, 91(11):1068–1077, 2017.

Maxime Bombrun, Petter Ranefall, Joakim Lindblad, Amin Allalou, Gabriel Partel, Leslie Solorzano, Xiaoyan Qian, Mats Nilsson, and Carolina Wählby. Decoding gene expression in 2D and 3D. In *Image Analysis*, pages 257–268. Springer, 2017.

Damien Gaudin, Jacopo Taddeucci, Piergiorgio Scarlato, Andrew Harris, **Maxime Bombrun**, Elisabetta Del Bello, and Tullio Ricci. Characteristics of puffing activity revealed by ground-based, thermal infrared imaging: the example of stromboli volcano (Italy). *Bulletin of Volcanology*, 79(3):24, 2017.

Maxime Bombrun, Letizia Spampinato, Andrew Harris, Vincent Barra, and Tommaso Caltabiano. On the transition from strombolian to fountaining activity: A thermal energy-based driver. *Bulletin of Volcanology*, 78(2):1–13, 2016.

Walter Georgescu, Alma Osseiran, Maria Rojec, Yueyong Liu, **Maxime Bombrun**, Jonathan Tang, and Sylvain V Costes. Characterizing the dna damage response by cell tracking algorithms and cell features classification using high-content time-lapse analysis. *PloS one*, 10(6), 2015.

Maxime Bombrun, Vincent Barra, and Andrew Harris. Analysis of thermal video for coarse to fine particle tracking in volcanic explosion plumes. In *Image Analysis*, pages 366–376. Springer, 2015.

Maxime Bombrun, Andrew Harris, Lucia Gurioli, Jean Battaglia, and Vincent Barra. Anatomy of a strombolian eruption: Inferences from particle data recorded with thermal video. *Journal of Geophysical Research: Solid Earth*, 120(4):2367–2387, 2015.

Talfan Barnie, **Maxime Bombrun**, Michael R. Burton, Andrew Harris, and Georgina Sawyer. Quantification of gas and solid emissions during strombolian explosions using simultaneous sulphur dioxide and infrared camera observations. *J. Volcanol. Geotherm. Res.*, 2014.

Maxime Bombrun, Vincent Barra, and Andrew Harris. Algorithm for particle detection and parameterization in high-frame-rate thermal video. *J. Appl. Remote Sens.*, 8(1):083549, 2014.

A. J. L. Harris, S. Valade, G. M. Sawyer, F. Donnadieu, J. Battaglia, L. Gurioli, K. Kelfoun, P. Labazuy, T. Stachowicz, **M. Bombrun**, V. Barra, D. Delle Donne, and G. Lacanna. Modern multispectral sensors help track explosive eruptions. *Eos*, 94(37):321–322, 2013.

Conference Proceedings

Maxime Bombrun, Jonathan Dash, Heidi Dungey, and Michael Watt. A machine learning approach to assess productivity at forest scale. In *15th Science Coding Conference*, Rotorua, New Zealand, August 2018.

Maxime Bombrun, Hui Gao, Petter Ranefall, Niklas Mejhert, Peter Arner, and Carolina Wählby. A new hybrid algorithm for quantitative high-content/high-throughput microscopy analysis of adipogenesis models. In *NEUBIAS2020 Symposium*, Lisbon, Portugal, February 2017.

Maxime Bombrun, Petter Ranefall, and Carolina Wählby. A web application to analyse and visualize digital images at multiple resolutions. In *3rd Digital Pathology Congress*, London, UK, December 2016.

Maxime Bombrun, Petter Ranefall, and Carolina Wählby. Tissuemaps: A large multi-scale data analysis platform for digital image application built on open-source software. In *4th Nordic Symposium on Digital Pathology*, Linköping, Sweden, November 2016.

Maxime Bombrun and Anne E. Carpenter. Scientific tutorial: Configuring accurate cell detection in images using cellprofiler. In *31st Congress of the International Society for Advancement of Cytometry*, Seattle, USA, June 2016.

Maxime Bombrun, David Jessop, Andrew Harris, and Vincent Barra. Plume tracking algorithm: Parameterisation of volcanic plume dynamics. In *IUGG General Assembly*, Prague, CZK, July 2015.

Maxime Bombrun, Vincent Barra, and Andrew Harris. Analysis of thermal video for coarse to fine particle tracking in volcanic explosion plumes. In *19th Scandinavian Conference on Image Analysis*, Copenhagen, Denmark, June 2015.

D. Gaudin, J. Taddeucci, A. Harris, T. Orr, **M. Bombrun**, and P. Scarlato. When puffing meets strombolian explosions: a tale of precursors and coda. In *2014 Fall Meeting, AGU*, San Francisco, Calif., December 2014.

P. Scarlato, J. Taddeucci, E. Del Bello, Gaudin D., T. Ricci, D. Andronico, L. Lodato, F. Cannata, T. Orr, J. Sesterhenn, R. Plescher, Y. Baumgarter, A. Harris, **M. Bombrun**, T. Barnie, B. Houghton, U. Kueppers, and A. Capponi. The 2014 Broadband Acquisition and Imaging Operation (BAcIO) at Stromboli volcano (Italy). In *2014 Fall Meeting, AGU*, San Francisco, Calif., December 2014.

M. Bombrun, A.J.L. Harris, V. Barra, L. Gurioli, and J. Battaglia. Anatomy of a strombolian plume: inferences from particle data. In *AGU Fall Meeting Abstracts*, volume 1, page 07, 2014.

M. Bombrun, V. Barra, and A. Harris. Particle detection and velocity prediction for volcanic eruptions: a preliminary study. In *IAVCEI*, Kagoshima city, Japan, July 2013.

S. Valade, A. Harris, Sawyer G., F. Donnadieu, P. Labazuy, K. Kelfoun, **M. Bombrun**, V. Barra, C. Hervier, M. Ripepe, D. Delle Donne, G. Lacanna, L. Chevalier, and T. Stachowicz. Full bandwidth remote sensing for total parameterization of volcanic plumes. In *IAVCEI*, Kagoshima city, Japan, July 2013.