



RESEARCH CENTER
Sophia Antipolis - Méditerranée

FIELD

Activity Report 2015

Section Highlights of the Team

Edition: 2016-03-21

1. ABS Project-Team	4
2. ACUMES Team (section vide)	6
3. AOSTE Project-Team	7
4. APICS Project-Team (section vide)	8
5. ASCLEPIOS Project-Team	9
6. ATHENA Project-Team (section vide)	10
7. AYIN Team	11
8. BIOCORE Project-Team	12
9. CASTOR Project-Team (section vide)	13
10. COATI Project-Team	14
11. COFFEE Project-Team (section vide)	15
12. DEMAR Project-Team (section vide)	16
13. DIANA Project-Team	17
14. ECUADOR Project-Team (section vide)	18
15. FOCUS Project-Team	19
16. GALAAD2 Team (section vide)	20
17. GEOMETRICA Project-Team	21
18. GRAPHDECO Project-Team	22
19. GRAPHIK Project-Team	23
20. HEPHAISTOS Project-Team	24
21. INDES Project-Team (section vide)	25
22. LAGADIC Project-Team	26
23. LEMON Team	27
24. MAESTRO Project-Team	28
25. MARELLE Project-Team (section vide)	29
26. MCTAO Project-Team (section vide)	30
27. MODEMIC Project-Team	31
28. MORPHEME Project-Team	32
29. NACHOS Project-Team (section vide)	33
30. NEUROMATHCOMP Project-Team	34
31. SCALE Team	35
32. STARS Project-Team	36
33. TITANE Project-Team	37
34. TOSCA Project-Team	38
35. VIRTUAL PLANTS Project-Team	39
36. WIMMICS Project-Team	40
37. ZENITH Project-Team	41

ABS Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

In 2015, several achievements are worth noticing in three realms, namely in computer science, computational structural biology, and software.

4.1.1. Computer Science

► Beyond Two-sample-tests: Localizing Data Discrepancies in High-dimensional Spaces

Reference: [17]

In a nutshell: A classical problem in statistics is to decide whether two populations exhibit a statistically significant difference—the so-called two-sample test problem (TST). If so, another classical problem is to assess the magnitude of the difference—the so-called effect size calculation. While various effect size calculations were available for univariate data, hardly any existed for multivariate data.

Assessment: In this work, we provide one of the very first (if not the first) effect size calculation for multivariate data. The method combines techniques from machine learning (regression) and computational topology (topological persistence).

4.1.2. Computational Structural Biology

► High Resolution Crystal Structures Leverage Protein Binding Affinity Predictions

Reference: [20]

In a nutshell: The binding affinity of two proteins forming a complex is a key quantity, whose estimation from structural data has remained elusive, a difficulty owing to the variety of protein binding modes. In this work, we present sparse models using up to five variables describing enthalpic and entropic variations upon binding, and a (cross-validation based) model selection procedure identifying the best sparse models built from a subset of these variables.

Assessment: Our estimation method ranks amongst the top two or three known so far, and is possibly the most accurate when applied to high resolution crystal structures. One of its key limitations (similar to contenders) is that the crystal structures of the partners and that of the complex are required. This limitation motivates our work on energy landscapes, see below.

► Unveiling Contacts within Macro-molecular assemblies by solving Minimum Weight Connectivity Inference Problems

Reference: [14]

In a nutshell: Following the 2002 Nobel prize in chemistry of Fenn and Tanaka, and the recent developments led in particular by Carol Robinson (Oxford), native mass spectrometry is about to become a technique of major importance in structural biology, providing information on large assemblies (more than 10 subunits) studied in solution. One key question is to infer pairwise contacts between subunits from native mass spectrometry data.

Assessment: In this work, we provide a method to predict pairwise contacts between subunits of a large assembly, based on the composition of oligomers. The method is based on a mixed linear integer program, and essentially doubles the prediction performances of the method developed by Robinson et al.

► Hybridizing Rapidly Growing Random Trees and Basin Hopping Yields an Improved Exploration of Energy Landscapes

Reference: [22]

In a nutshell: Energy landscapes of biomolecular systems code their emergent thermodynamic and kinetic properties, so that their exploration is a question of paramount importance. This task requires in particular finding (metastable) states and their occupancy probabilities. Landscape exploration methods can be ascribed to two categories: continuous methods related to molecular dynamics, and discrete methods related to Monte Carlo sampling.

Assessment: In this work, we present a discrete sampling method combining features of robotics inspired methods (rapidly expanding random trees), and of biophysics inspired methods (basin hopping). Our hybrid algorithm outperforms contenders significantly. It is possibly one of the most efficient sampling method for energy landscapes known to date, but making such a statement will require testing thoroughly on a variety of systems. The method may strike a major impact if we manage to qualify the conformational ensembles generated from a thermodynamic standpoint.

► **Conformational Ensembles and Sampled Energy Landscapes: Analysis and Comparison**

Reference: [16]

In a nutshell: A paper presenting novel methods to analyze conformational ensembles and sampled energy landscapes, using techniques from optimal transportation theory and computational topology.

Assessment: The method proposed significantly enriches those classically used in biophysics, and triggered a collaboration with David Wales (Cambridge), one of the leading scientists on energy landscapes.

4.1.3. The Structural Bioinformatics Library

We released the Structural Bioinformatics Library, a library whose main features are detailed below.

ACUMES Team (section vide)

AOSTE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Robert Davis, from York University, got awarded an Inria International Chair to spend a year over a duration of five years as full member of the Aoste EPI.

APICS Project-Team (section vide)

ASCLEPIOS Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

- Thomas Benseghir received a Best Paper Award at the 2015 IPCAI conference, Barcelona, Spain, for his paper entitled “A tree-topology preserving pairing for 3D/2D registration”, co-authored by Grégoire Malandain and Régis Vaillant.
- Matthieu Lê received a Young Scientist Award at the 2015 MICCAI conference, Munich, Germany, for his paper entitled “GPSSI: Gaussian Process for Sampling Segmentations of Images” , co-authored by Jan Unkelbach, Nicholas Ayache, and Hervé Delingette.
- Bjorn Menze received the Young Scientist Publication Impact Award at the 2015 MICCAI conference, Munich, Germany, for his article “A generative model for brain tumor segmentation in multi-modal images”, co-authored by Koen Van Leemput, Danial Lashkari, Marc-André Weber, Nicholas Ayache and Polina Golland presented at MICCAI 2010 in Beijing, China [100].
- Marco Lorenzi received an honorary mention at the 2015 Cor Baayen Award for his PhD prepared jointly within the Asclepios project team at Inria Sophia Antipolis and the IRCCS San Giovanni di Dio Fatebenefratelli (Italy), and for his post-doctoral research performed at University College London (UCL).
- Hervé Delingette is the co-recipient of the Dirk Bartz First Prize for Visual Computing in Medicine awarded during the 2015 Eurographics conference. The prize was given to a group of 7 Inria researchers who pioneered the development of medical simulators based on the SOFA software platform.
- Nicholas Ayache received a research medal from the University Côte d’Azur on December 10th 2015.

BEST PAPERS AWARDS :

[26] **International Conference on Information Processing in Computer-Assisted Interventions, IPCAI 2015.** T. BENSEGHIR, G. MALANDAIN, R. VAILLANT.

[38] **MICCAI - Medical Image Computing and Computer Assisted Intervention - 2015.** M. LÊ, J. UNKELBACH, N. AYACHE, H. DELINGETTE.

ATHENA Project-Team (section vide)

AYIN Team

5. Highlights of the Year

5.1. Highlights of the Year

- Yuliya Tarabalka (Inria junior researcher) and Emmanuel Maggiori (PhD student) moved from AYIN [<https://team.inria.fr/ayin/>] to TITANE [<https://team.inria.fr/titane/>] team in January.
- Josiane Zerubia was nominated in November IEEE Signal Processing Society (SPS) Distinguished Lecturer for a duration of 2 years [<http://www.signalprocessingsociety.org/newsletter/2015/11/sps-announces-2016-class-of-distinguished-lecturers/>].

BIOCORE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Metabolic mathematical models are required to fully understand and optimize the microalgae lipid metabolism and finally maximize biofuel production. However, unlike heterotrophic microorganisms that use the same substrate as sources of energy and carbon, photoautotrophic microorganisms require light for energy and CO₂ as carbon source. Furthermore, they are submitted to permanent fluctuating light environments due to outdoor cultivation or mixing inducing a flashing effect. Modelling these nonstandard organisms is therefore a major challenge for which classical tools are often inadequate. This year, the work consisted in assessing and comparing the potential of several approaches for modelling microalgae. As a conclusion, the DRUM approach developed within Biocore seems highly promising since it requires a lowest number of parameters while it can predict internal accumulation during transients [14].
- We study the occurrence of periodic solutions in an n -dimensional class of negative feedback systems defined by smooth vector fields. By circumscribing the smooth system by two piecewise linear ones, we show that there exists an invariant toroidal region which contains a periodic orbit of the original smooth system [37]. The strong point of this work is that it makes a link between hybrid piecewise linear systems (where computations are easier) and smooth classical systems.
- We developed a plant epidemic model to address the epidemiological and evolutionary management of plant virus epidemics in agricultural landscapes using resistant cultivars. Based on the principles of cultivar mixtures and cultivar rotations, we explored different resistance deployment strategies and their impact on disease prevalence and pathogen evolution. Overall, combining cultivar mixtures and rotations provided most efficient and durable pathogen control [25].

CASTOR Project-Team (section vide)

COATI Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Bi Li, former PhD student of COATI, is recipient of the Chinese government award for outstanding self-financed students abroad, edition 2014, for her PhD thesis entitled "Tree Decompositions and Routing Problems".

Fatima Zahra Moataz received the best student paper award of the conference ALGOTEL 2015.

BEST PAPERS AWARDS :

[51] **ALGOTEL 2015 — 17èmes Rencontres Francophones sur les Aspects Algorithmiques des Télécommunications.** F. ZAHRA MOATAZ.

COFFEE Project-Team (section vide)

DEMAR Project-Team (section vide)

DIANA Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

A second session of the Python MOOC by Arnaud Legout and Thierry Parmentelat has been programmed in 2015 and it was also a very big success: 9615 persons registered to the course, out of them 1487 qualified for the final attestation of achievement. This session is innovative in its form as well, since it introduced ipython notebooks as medium for complementing videos; this medium has allowed to add runnable/editable programs fragments inside written material, so that students can readily run and or modify the numerous examples that illustrate the languages' concepts. Arnaud and Thierry are preparing a sequel that will address python3; they also hope to be able to leverage on the notebooks technology, and to widen the spectrum of their day-to-day usages beyond educational purposes, and in particular towards research-oriented activities like runnable papers. For more details on this MOOC see <https://www.france-universite-numerique-mooc.fr/courses/inria/41001S02/session02/about>

4.1.1. Awards

Our paper Automating ns-3 Experimentation in Multi-Host Scenarios, got the Best Paper Award at the ns-3 Workshop (WNS3), May 2015, Barcelona, Spain. The NEPI experiment management framework is capable of automating deployment, execution, and result collection of experiment scenarios that combine ns-3 with multiple hosts in various ways, reducing the burden of manual scenario setup. The awarded paper describes the internals of the NEPI framework and demonstrates its usage for ns-3 multi-host scenarios with three example cases: a) running parallel simulations on a cluster of hosts, b) running distributed simulations spanning multiple hosts, and c) integrating live and simulated networks.

BEST PAPERS AWARDS :

[18] WNS3 2015. A. QUEREILHAC, D. SAUCEZ, T. TURLETTI, W. DABBOUS.

ECUADOR Project-Team (section vide)

FOCUS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- Ugo Dal Lago won the 2015 award of ‘Best Young Researcher in Theoretical Computer Science’ given by the Italian Chapter of the EATCS (European Association for Theoretical Computer Science).
- Ornella Dardha, former Focus PhD student, now at Glasgow University, won the award for ‘Best Italian 2015 PhD Thesis in Theoretical Computer Science’ given by the Italian Chapter of the EATCS.
- The Focus constraint programming solver, called `sunny-cp`, won the ‘2015 MiniZinc Challenge’, <http://www.minizinc.org/challenge.html>, an annual competition of constraint programming solvers in the open category (the most challenging), featuring all the most efficient solvers in the world.
- Fabrizio Montesi, external collaborator in Focus, won the EAPLS (European Association for Programming Languages and Systems) ‘Best PhD Dissertation Award 2014’.

BEST PAPERS AWARDS :

[44] **Proceedings of 6th IPM International Conference on Fundamentals of Software Engineering (FSEN 2015)**. D. HIRSCHKOFF, J.-M. MADIOT, X. XU.

GALAAD2 Team (section vide)

GEOMETRICA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Clément Maria has been awarded the Prix de thèse Gilles Kahn - Académie des Sciences.

5.1.2. Books

Steve Oudot published a book on persistence theory in the AMS series *Mathematical Surveys and Monographs* [35].

GRAPHDECO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

This was the first year of existence of GRAPHDECO, which was officially created in July 2015. The group has advanced on its main research axes, that of Computer-Assisted Design with Heterogeneous Representations and Graphics with Uncertainty and Heterogeneous Content. Our most notable results are our ACM Transactions on Graphics papers on regularized curvature fields [7], multi-view intrinsic images and relighting [6] and finally computer-assisted crafting on wire-wrapping [8]. The ANR DRAO was completed in December with an excellent review result, and the EU project CR-PLAY was also evaluated with excellent results for its 2nd year. Two Ph.D. students graduated this year (S. Duchêne [2] and E. Iarussi [3]) and A. Bousseau defended his Habilitation [1].

5.1.1. Awards

Kenneth Vanhoey received a thesis award from the University of Strasbourg, from which he graduated in 2014. Johanna Delanoy and Adrien Bousseau won second best paper award in the AFIG [5].

GRAPHIK Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Michel Chein was nominated at the **Academy of Science and Literature from Montpellier** (Académie des Sciences et des Lettres de Montpellier). It is the first nomination of a computer scientist in this academy.
<http://www.inria.fr/centre/sophia/actualites/michel-chein-elu-membre-de-l-academie-des-sciences-et-lettres-de-montpellier>
- By joining the team, Meghyn Bienvenu (CR researcher) brings her deep expertise in description logics and complexity, in particular applied to ontology-based data access, a core focus in GraphIK. She was recently put forward by the national committee of the CNRS (“section 6 du comité national”, <http://cn6.fr/>) to receive the bronze medal of the CNRS.

HEPHAISTOS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Science

- strong advances on the analysis of cable-driven parallel robots (section 7.1.1)
- collaboration with lawyers on the ethical and legal aspects of robotics
- strong collaboration with the medical community on walking analysis and rehabilitation (section 7.1.2.2)

5.1.2. Experimentation

- start of an extensive test period for our walkers in clinical environment (section 7.1.2.2)
- start of the daily activities monitoring in our building (section 7.1.2.4)
- the workshop *Computer science for artists*

5.1.3. Transfer

- the contract with GénérationRobot for the development of a pedagogical cable-driven parallel robot

5.1.3.1. Awards

- J-P. Merlet has been nominated as IEEE Fellow and doctor honoris causae from University Innsbruck. He was also awarded a prize from Cote d'Azur University
- Y. Papegay was awarded the Wolfram Innovator Award

INDES Project-Team (section vide)

LAGADIC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- The work of Lucas Royer and Alexandre Krupa concerning non-rigid target tracking in ultrasound images [47] (see Section 7.6.1) was awarded by the organizers of the MICCAI CLUST'15 challenge (MICCAI Challenge on Liver Ultrasound Tracking) as being the best method for real-time and accurate target tracking in 3D ultrasound sequences.
- Paolo Robuffo Giordano has been awarded as Best Associate Editor of ICRA'2015.

LEMON Team

5. Highlights of the Year

5.1. Highlights of the Year

- In 2015, the *Marine Energies Research International Center* (MERIC) was launched in Chile. Antoine ROUSSEAU will be the scientific coordinator for Inria, and several members of LEMON, CARDAMOM and TOSCA research teams will be involved in this 8 years project in partnership with DCNS and Enel.
- Antoine ROUSSEAU co-organized the **CEMRACS 2015**, in Marseilles: 6 weeks with more than 100 participants.
- Fabien MARCHE and Antoine ROUSSEAU co-organized the workshop **Numerical Models for Coastal Hazards** in Montpellier.

5.1.1. Awards

- Carole Delenne's project **Cart'Eaux** was selected in the Languedoc Roussillon *Chercheur d'avenir* competition.
- The GERIMU project has earned a distinction from the local Scientific Advisory Committee ("Coup de coeur du COSTI").

MAESTRO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Project P11 “Data Communication Network Performance” with ALSTOM Transport (see §8.1.3) that was originally planned until May 2015 was extended for one additional year.
- The demonstration “Quantum random walk in networks” made at Bell Labs Future X days (Openday), Paris, France , on 10-11 June 2015 was the subject of an article in the journal *Industries & Technologies* titled “Une méthode quantique pour prédire l’évolution des réseaux”. (Link for subscribers only: <http://www.industrie-techno.com/une-methode-quantique-pour-predire-l-evolution-des-reseaux.38856>.)
- Giovanni Neglia was invited to give a 20-hour PhD course on Complex Networks at the Univ. of Pisa, Italy, on 23-27 March 2015.
- 2015 is the 7th year of official collaboration with Indian institutions (IISc and IIT Mumbai).

MARELLE Project-Team (section vide)

MCTAO Project-Team (section vide)

MODEMIC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The project Soil μ 3D, which Modemic is a partner, has been selected and funded by the ANR (French National Research Agency) for the 2015-2019 period.

Alain Rapaport has been invited to give a plenary session at the next CMPDE'16⁰ (Conference in Mathematical Population Dynamics and Epidemiology), Marseille, 5–9 September 2016.

⁰ <http://mpde16.mio.univ-amu.fr/>

MORPHEME Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Prizes and distinctions

L. Blanc-Féraud has been declared Knight of the Legion of Honor september the 25th.

Awards

T. Benseghir and G. Malandain have received a best paper award at the IPCAI conference.

X. Descombes has co-authored of a paper that received the best student paper award at the Workshop on Diff - CV.

BEST PAPERS AWARDS :

[3] **International Conference on Information Processing in Computer-Assisted Interventions, IPCAI 2015.** T. BENSEGHIR, G. MALANDAIN, R. VAILLANT.

[5] **1st iInternational Workshop on Diff - CV: Differential Geometry in Computer Vision for Analysis of Shapes, Images and Trajectories (in conjunction with BMVC).** A. DUNCAN, E. KLASSEN, X. DESCOMBES, S. ANUJ.

NACHOS Project-Team (section vide)

NEUROMATHCOMP Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Awards

Olivier Faugeras received the Okawa Foundation Prize for "Pioneering contributions for computer vision and for computational neuroscience". The prize was awarded to him in Tokyo, Japan, in March 2015. He received the PAMI Azriel Rosenfeld Lifetime Achievement Award in December 2015 at the ICCV 2015 in Santiago, Chile. This award is given to researchers in Computer Vision who have made major contributions to the field over their career and who have influenced the field in an extraordinary way.

Habilitation à Diriger des Recherches (HDR) Mathieu Desroches has defended an habilitation thesis on the 11th December 2015 at the Université Pierre et Marie Curie - Paris 6. The title of his habilitation thesis is *Complex oscillations with multiple timescales - Application to neuronal dynamics* [15]. The reviewer of this HDR were: Eusebius J. Doedel (Concordia University, Canada), Christopher K. R. T. Jones (University of North Carolina at Chapel Hill, USA) and Daniel Panazzolo (Université de Haute-Alsace, France). The jury was formed by : Stephen Coombes (University of Nottingham, UK), Peter De Maesschalck (Hasselt University, Belgium), Olivier Faugeras (Inria Sophia Antipolis, France), Jean-Pierre François (President of the Jury, Université Pierre et Marie Curie - Paris 6, France), Christopher K. R. T. Jones (University of North Carolina at Chapel Hill, USA) and Daniel Panazzolo (Université de Haute-Alsace, France).

SCALE Team

5. Highlights of the Year

5.1. Highlights of the Year

Workshops and Conférence organization

- Organisation of a workshop on active object languages in September 2015

STARS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

This year Stars has proposed new algorithms in the domains of perception for activity recognition and semantic activity recognition.

5.1.1. Perception for Activity Recognition

For perception, the main achievements are:

- A new Re-Identification algorithm which outperforms the State-of-the-art algorithms while being adapted to real-world applications (i.e. it does not require the use of heavy manual annotations which is typical of metric learning algorithms). The remaining challenge is to be able to distinguish people who have similar appearance.
- A new generic action recognition algorithm which outperforms the State-of-the-art algorithms. This algorithm uses new action descriptors that enable finer gesture classification. An open issue is to get a real-time implementation with good enough performance. An extension of this algorithm has been devised for RGB-D cameras, which has been demonstrated in a real-life application, where a robot has to recognize people taking their meal (e.g. eating, drinking).
- New generic tracking algorithms, which can optimize the on-line tuning of tracking parameters and can operate at different temporal scales to recover from lost tracklets. These tracking algorithms have been validated on real world videos lasting more than a week. The utilization of such sophisticated algorithms is still complex and requires some more researches for their deployment in a large variety of applications.

5.1.2. Semantic Activity Recognition

For activity recognition, the main advances on challenging topics are:

- New tools to help modeling human activities of daily living. These tools enable to evaluate and improve activity recognition algorithms on long videos depicting the performance of older people living in a nursing home in Nice. The utilization of these tools by clinicians and medical doctors is an ongoing task.
- A new algorithm to recognize human activities, that can benefit from the fusion of events coming from camera networks and heterogeneous sensors.
- A new algorithm to discover human activities of daily living by processing in an unsupervised manner a large collection of videos. The generation of the event models does not require the use of heavy manual annotations which is typical of supervised activity recognition algorithms. However this algorithm still need to have well tracked people to be able to understand their behaviors with sufficient precision.

TITANE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Yuliya Tarabalka has joined our team since January 2015, making our initial objective to implement a synergy between geometry and image/vision more concrete.

On robust reconstruction of complex shapes and scenes we obtained a wide range of new results. One noticeable result is an approach for reconstruction of indoor scenes, which received the U. V. Helava Award Best Paper 2014. In our quest for semantized reconstruction we contributed an approach for reconstruction of levels of details of urban scenes, in accordance to the CityGML format. This work has been published in ACM Transactions on Graphics, and presented at ACM SIGGRAPH 2015. We also contributed a robust 3D reconstruction approach for underwater scenes, the latter exhibiting many new challenges in terms of data defect such as uncertainty and unprecedented level of outliers. Finally, we contributed a STAR (state of the art) report at the EUROGRAPHICS conference on 3D reconstruction from point clouds, which is being converted into a survey for the Computer Graphics Forum journal.

Our two-year efforts on the problem of isotopic shape approximation have turned into a new publication at the premier venue in Computer Graphics: the ACM SIGGRAPH conference 2015, and a patent. We derived a novel algorithm that generates a surface triangle mesh, given an input tolerance volume guaranteed to be within the tolerance, intersection free and topologically correct. Despite being a long standing problem, there was still no robust and practical solution to this enduring scientific challenge. This problem is both relevant to, and timely for, the increasing variety of industrial applications that involve raw geometric data.

The scientific impact of our contributions is illustrated by publications in premier journal and conference venues in our field, both in geometry processing and computer vision: ACM Transactions on Graphics and SIGGRAPH, Computer Graphics Forum, EUROGRAPHICS, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), IJCV, IJRS/ISPRS. Note also that our work on underwater reconstruction has been published in the premier journal on robotic research.

Awards

Xavier Rolland-Nevière obtained the best student paper award for “track IFS” of ICASSP (IEEE International Conference on Acoustics, Speech and Signal Processing) .

Sven Oesau, Florent Lafarge and Pierre Alliez received the U.V. Helava Award Best Paper for year 2014: “Indoor Scene Reconstruction using Feature Sensitive Primitive Extraction and Graph-cut”. ISPRS Journal of Photogrammetry and Remote Sensing, 2014.

BEST PAPERS AWARDS :

[16] **IEEE International Conference on Acoustic, Speech Signal Processing (ICASSP)**. R.-N. XAVIER, G. DOËRR, P. ALLIEZ.

TOSCA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- M. Deaconu, B. Dumortier and E. Vincent won a poster award price (<http://www.ewea.org/annual2015/conference/programme/> and <http://www.inria.fr/centre/nancy/actualites/ewea-2015-baldwin-dumortier-recoit-un-prix-d-honneur>) for their work with the Venathec SAS on the acoustic control of wind farms.

VIRTUAL PLANTS Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

- *Statistical methods*: One of our main activities consists of identifying and characterizing developmental patterns in plant phenotyping data. Phenotyping data are very diverse ranging from the tis-sular to the whole plant scale but are often highly structured in space, time and scale. We intend to analyse such data using state-of-the-art methods at the crossroad between statistical modelling, machine learning and pattern recognition. This generates regularly new methodological results as illustrated this year by [17] and [22].
- *Scientific Workflows*: Analyzing biological data may involve very complex and interlinked steps where several tools are combined together. Scientific workflow systems have reached a level of maturity that makes them able to support the design and execution of such in-silico experiments, and thus making them increasingly popular in the bioinformatics community. However, in some emerging application domains such as system biology, developmental biology or ecology, the need for data analysis is combined with the need to model complex multi-scale biological systems, possibly involving multiple simulation steps. This requires the scientific workflow to deal with retro-action to understand and predict the relationships between structure and function of these complex systems. In collaboration with the Zenith EPI, we have proposed a conceptualisation of OpenAlea workflows [34] by introducing the concept of higher-order dataflows as a means to uniformly combine classical data analysis with modeling and simulation, in the context of plant phenotyping.
- *Mechanical model of meristem development*: The growth of plant tissues results from the growth of cells that are inflated by turgor pressure. In recent years, different bio-physical processes by which genes regulate locally the rate and the directions of cell growth have been identified. At tissue level, the growth of each region is mechanically constrained by the existence of neighboring regions. This creates stresses within the plant tissues, possibly with differential directional intensities, which in turn, can be sensed locally at the level of each individual cell by genes. Shapes thus results from the complex interplay between genes and growth, mediated by mechanics. In the recent years, we have been developing a model of growth of plant tissues that is able to represent this overall feedback mechanism [13]. This model is the first 3D approach of multicellular plant tissue development based on a tensorial representation of mechanical properties and stresses in cell walls. Its implementation relies on a coupling between OpenAlea and Sofa, two main software platforms for modeling in biology developed at Inria.

WIMMICS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Elena Cabrio successfully obtained an assistant professor position in Wimmics.
- Serena Villata successfully obtained a researcher position (CR1 CNRS) in Wimmics.
- Olivier Corby and Catherine Faron-Zucker received a medal from University Côte d'Azur on December 10th as a follow-up of their IC 2015 best paper award.
- HDR Defense of Freddy Lécué (Inria-IBM)
- Two successful MOOCs (HTML5, Semantic Web)
- Fabien Gandon was General Chair of ESWC 2015 and will be general co-chair of WWW 2018

5.1.1. Awards

BEST PAPERS AWARDS :

[39] **Journées francophones d'Ingénierie des Connaissances**. O. CORBY, C. FARON-ZUCKER.

ZENITH Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The Pl@ntNet application, co-developed by Zenith, exceeded 1M downloads in October 2015.