

Environment Observation through Complex Imagery:

Image Analysis, Machine Learning and Remote Sensing

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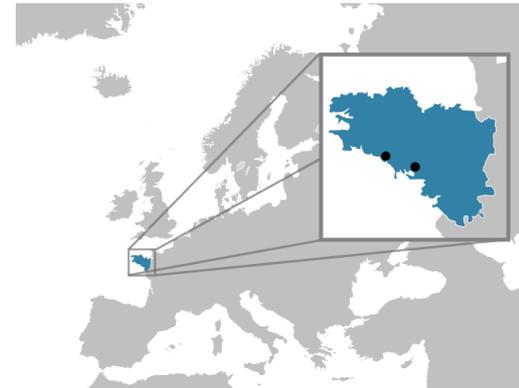
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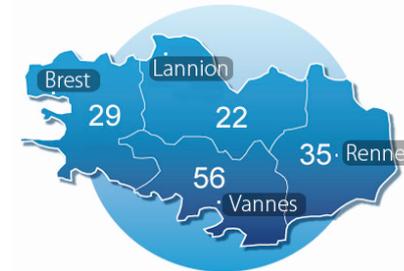
University of South Brittany (UBS) – www.univ-ubs.fr

- Officially created in 1995 in Vannes & Lorient (but faculties established in 70s)
- 9000+ students
250+ research (ass. or full) professors
150+ lecturers
- National ranking
Ranked 4th for professional insertion
Ranked 8th for success rate
- BSc, BTech, MSc, PhD in Computer Science / IT



Institute for Research in Computer Science and Random Systems (IRISA) – www.irisa.fr

- CNRS, INRIA, 2 universities, 4 graduate schools
Among the largest IT research center:
- 800 researchers, 40 teams, 4 sites



- in Vannes, campus of Tohannic
50 researchers, 4 teams : ARCHWARE, CASA, EXPRESSION, OBELIX





OBELIX Team: www.irisa.fr/obelix

- **Vannes (UBS) & Rennes (OSUR, LETG-Costel, CNRS-UR2)**

- **9 Permanent researchers**

S. Lefèvre (PR UBS), team leader

T. Corpetti (DR CNRS)

N. Courty (MCF HDR UBS)

R. Tavenard (MCF UR2)

L. Chapel (MCF UBS)

L. Courtrai (MCF UBS)

C. Friguet (MCF UBS)

F. Merciol (MCF UBS)

Y. Le Guyadec (MCF UBS)

- **2 Post-docs (CNES, ANR) + 1 in 2016**

- **1 Ass. Researcher (WIPSEA Rennes)**

- **7 PhDs (3 started in 2013, 4 in 2015) + 3 in 2016**

- **5-10 MSc / BSc interns**



OBELIX = Environment Observation through Complex Imagery

■ Research areas

- image analysis and processing
- machine learning and data mining
- coupling physical models with observation data
- visual analytics
- in the context of remote sensing of environment

■ Challenges

- Address complex data (multi*, massive, heterogeneous, noisy/missing)
- Exploit prior knowledge
- Putting the user in the loop

OBELIX PhDs

- 2012 ■ ***Petra Bosilj : tree-based methods for CBIR (defended)***
- 2013 ■ **Yanwei Cui : kernels on trees for image classification**
 - **Romain Huet : sparse neural networks, auto-associative memories**
 - **Sina Nakhostin : unmixing of hyperspectral data**
- 2015 ■ **Adeline Bailly : classification of time series**
 - **Roberto Giudici : mosaicking & recognition in dynamic scenes,**
 - **Nicolas Audebert : deep learning for semantic segmentation**
 - **Jamila Mfidal : multi/hyperspectral super-resolution**
- 2016 ■ **Mathieu Laroze : (inter)active object detection**
 - **David Bertran: trees for 3D data (full-waveform LiDAR)**
 - **Arthur Guillerey: Classification of massive topo-bathymetric LiDAR data**

Active Projects and Grants

- **RESIDUAL (ISSI, 2014-2016)**
 - remote sensing image data assimilation for pollution monitoring
- **OBIATS (PHC Pamoja, 2016-2017)**
 - monitoring of tree species using OBIA on SITS

- **ASTERIX (ANR, 2013-2017)**
 - Image analysis and machine learning for remote sensing
- **VEGIDAR (CNES, 2014-2017)**
 - Coupling Pléiades & LiDAR for urban vegetation mapping
- **Littoralg (UBS, 2013-2017)**
 - Coastal monitoring and seaweed valorisation
- **SENSE (Labex, 2013-2017)**
 - Smart retina using GBNN (at analogical, HW, and SW levels)

- **DELORA (Innovative Cluster, 2016-2019)**
 - Detection and visualization (AR) of buried networks
- **WIPSEA (industrial collaboration)**
 - Aerial image analysis for wildlife monitoring
- **SIRS (industrial collaboration)**
 - Scalability of land cover mapping techniques (e.g. VHR Europe)

Collaborations



+

China
(LIAMA, CAS, NLPR,
Tsinghua, IRISA)

Singapore
(NTU, IPAL/NUS, Thalès)

Kenya (TUK)

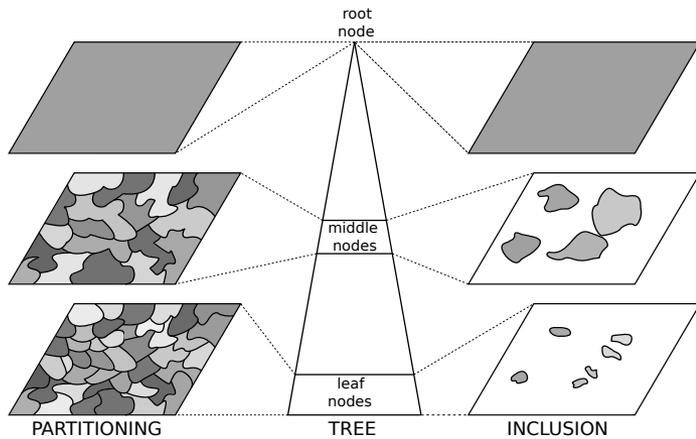
Brazil, Mexico...

Recent achievements (beyond PhD works)

- **knowledge-driven features & models for description of multivariate data** (TGRS'16, IGARSS'15, WHISPERS'14, ICIP'14, ALCIP'13)
- **efficient algorithms for hierarchical image representation and analysis** (BiDS'16, ACIVS'15, PRRS'14 + PRL, ISMM'15, ISMM'13 + JRTIP)
- **classification of time series, change detection, optical flow (SAR, multispectral)** (JURSE'15, JARS'14, RS'14, TIP'14, JSTARS'13)
- **domain adaptation for classification of hyperspectral data** (ECML'14, ICPR'14, MultiTemp'15, IGARSS'16)
- **manifold learning with few labeled samples** (JSTARS'14)
- **active sets / feature learning** (IJPRS'15 + U.V. Helava Award 2012-2015, PCV'14 best paper)
- **non-negative matrix factorization** (ML'14)
- **anomaly detection** (ECML'14)
- **manifold subsampling** (GSI'13)
- **ensemble methods** (IGARSS'16)
- **camera-based mobile mapping** (MMT'15 + GSIS)

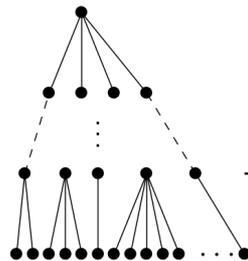
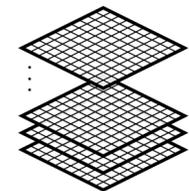
Key Methodologies

Trees



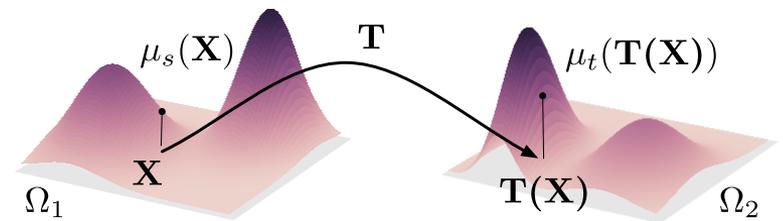
Tree construction and management

Complex data

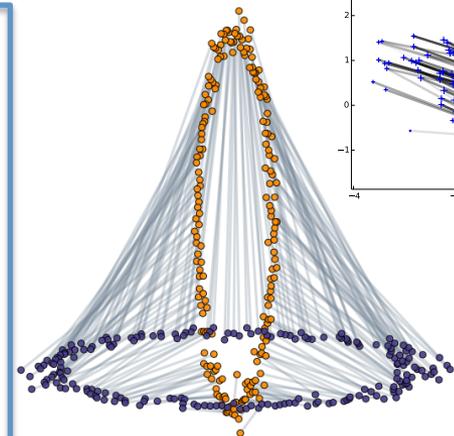
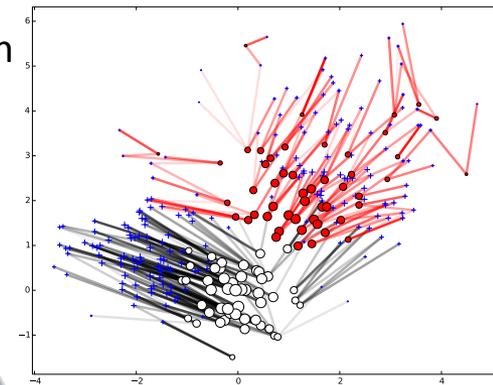


Various applications:
 Feature extraction
 Description
 Segmentation
 Classification
 Retrieval
 ...

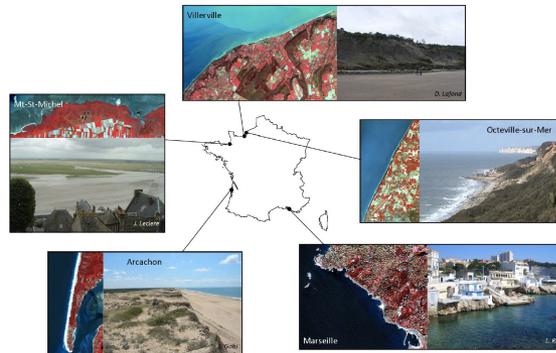
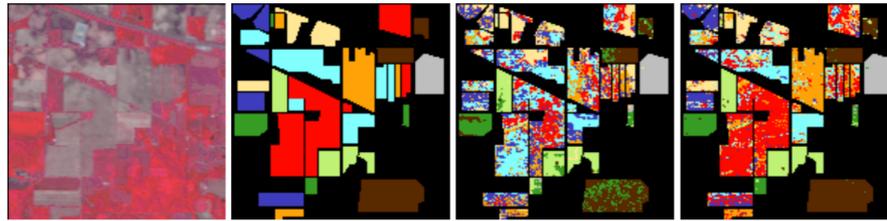
Optimal Transport



Domain adaptation
 Multitemporal classification
 Shape matching
 ...



Some visual examples



Class	Soil	Tennis c.	Run track	Parking 2	Residential	Str. grass	Road	Water
RGB								
GT								
Classification (AS-axis)								
Feature: 31 Entropy, 15 x 15 Band 1-5 (Lolr) Active in 11 classes								
Feature: 11 Ambigu area Band 1-5, 2010 pix. Active in 11 classes								
Feature: 12 Ambigu area Band 08, 2010 pix. Active in 12 classes								
Feature: 3 Closing, diamond Band 1 (0, 7 x 7 Active in 11 classes								
Feature: 46 Closing, rec. top hat Band 106, 15 x 15 Active in 5 classes								

Some sights of Brittany

**Invited scientists
& MSc/PhD/Postdocs candidates
are welcome...**



and closer to Ghent !

