

Loic Landrieu

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Loic Landrieu

Structured machine learning for remote sensing

Summary I am a researcher at IGN—the French Mapping Agency—in the machine learning team STRUDEL. I develop graph-structured optimization and learning algorithms leveraging the data structure of real-life problems (be it spatial, temporal, spectral, or modal) for improved precision and efficiency. I have a special interest for large-scale remote sensing applications. I am also a course instructor in machine learning at ENSG (IGN's school of geomatics) and ENPC.

Positions and Research Experience

2015–present : *Researcher, MATIS, IGN*

Structured learning for multi-source remote sensing.

2010–present: *Ingénieur des ponts, des eaux et des forêts, MEEDEEM*

2012 : *Research Assistant, INRIA*

Land cover prediction with continuously indexed Markov random fields.

Advisor: Guillaume Obozinski

2011 : *Research Assistant, INRIA*

Weakly supervised part-of-speech tagging in natural languages.

Advisor: Guillaume Obozinski

2011 : *Research Assistant, ENPC ParisTech*

Reviewer recommendations system from the citation graph.

Advisor: Jean-Yves Audibert

Teaching

- 2019 : AIMS, Master AMMI, *Teaching assistant* Probabilistic Graphical Models.
- 2019 : EUROSDR with EduSERV, *Course instructor* Deep learning for remote sensing.
- 2018-present : ENPC, Master IMI, *Teaching assistant* Introduction to machine learning.
- 2017–present : ENSG, Master PPMD, *Course instructor* Structured classification.
- 2016–2017 : ENSG, Master DesiGeo, *Course instructor* Introduction to machine learning.
- 2014 : ENS Cachan, *Teaching assistant* Probabilistic graphical models.

Education

2012 - 2016, ENPC ParisTech - INRIA - ENS Ulm, PhD

PhD in computer science / machine learning: *Learning structured models on weighted graphs, with applications to spatial data analysis.*

Advisors: Francis Bach and Guillaume Obozinski

2011 - 2012, ENS Cachan, MSc

Master MVA, machine learning and computer vision.

2011 - 2012, ENPC ParisTech, MSc

Master IMI, computers science and applied mathematics.

2007 - 2011, Ecole Polytechnique, MSc

Algorithmic and applied mathematics.

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Publications

Journal papers


- **2017, ISPRS:** Loic Landrieu, Hugo Raguét, Bruno Vallet, Clément Mallet, and Martin Weinmann, *A Structured Regularization Framework for Spatially Smoothing Semantic Labelings of 3D Point Clouds*.
- **2017, SIIMS/SIAM:** Loic Landrieu and Guillaume Obozinski, *Cut Pursuit: Fast Algorithms to Learn Piecewise Constant Functions on General Weighted Graphs*.
- **2015, SIIMS/SIAM:** Hugo Raguét and Loic Landrieu, *Preconditioning of a Generalized Forward-Backward Splitting and Application to Optimization on Graphs*.


Conferences


- **2019, IGARSS:** Vivien Sainte Fare Garnot, Loic Landrieu, Sebastien Giordano, Nesrine Chehata, *Time-Space Tradeoff in Deep Learning Models for Crop Classification on Satellite Multi-Spectral Image Time Series*.
- **2019, CVPR:** Loic Landrieu and Mohammed Boussaha, *Point Cloud Oversegmentation with Graph-Structured Deep Metric Learning*.
- **2019, ISPRS Workshop:** Stephane Guinard, Loic Landrieu, and Bruno Vallet *Piecewise-planar Approximation Of Large 3d Data As Graph-structured Optimization*.
- **2018, ICML:** Hugo Raguét and Loic Landrieu, *Cut-Pursuit Algorithm for Regularizing Nonsmooth Functionals with Graph Total Variation*.
- **2018, IGARSS:** Sébastien Giordano, Simon Bailly, Landrieu, Loic, and Nesrine Chehata, *Temporal Structured Classification of Sentinel 1 and 2 Time Series for Crop Type Mapping*.
- **2018, CVPR:** Loic Landrieu and Martin Simonovski, *Large-scale Point Cloud Semantic Segmentation with Superpoint Graphs*.
- **2017, IGARSS:** Loic Landrieu, Clément Mallet, and Martin Weinmann, *Comparison of Belief Propagation and Graph-Cut Approaches for Contextual Classification of 3D LiDAR Point Cloud Data*.
- **2017, ISPRS:** Stéphane Guinard and Loic Landrieu, *Weakly Supervised Segmentation-Aided Classification of Urban Scenes From 3D LiDAR Point Clouds*.
- **2016, AISTats:** Loic Landrieu and Guillaume Obozinski, *Cut Pursuit: Fast Algorithms to Learn Piecewise Constant Functions*.
- **2014, UAI:** Loic Landrieu and Guillaume Obozinski, *Continuously Indexed Potts Models on Unoriented Graphs*.

Software Development

I have an active github profile, with several open-source repositories:

 /superpoint-graph 261 ★ 75 📄

 /cut-pursuit 22 ★ 7 📄

 /point-cloud-regularization 11 ★ 8 📄

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Talks in Conferences and Invited Talks

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- 2019** • CVPR, Long Beach, USA (poster)
Point Cloud Oversegmentation with Graph-Structured Deep Metric Learning.
 - ISPRS Geospatial week, Univ. of Twente, Netherlands (tutorial)
Deep Learning for Point Clouds Semantic Segmentation.
 - Univ. Montpellier, France (invited talk)
Cut Pursuit for Optimizing with Graph-Structured Regularizers.
 - JURSE 2019, Vannes, France (tutorial)
Cut Deep Learning for Point Clouds Semantic Segmentation.
 - Univ. Paris-Est, France. (invited talk)
Deep Learning for 3D Point Cloud Semantic Segmentation.
 - Conference on IGN Research, France (organizer)
 - EuroSDR Barcelona, Spain (lecturer)
Deep Learning for 3D Point Clouds Analysis.
- 2018** • Univ. of Erlangen, Germany (invited talk)
Deep Metric Learning on Point Clouds.
 - Optimization in Image Analysis Summer School, Copenhagen. (invited lecturer for two classes)
 - ICML, Stockholm, Sweden. (poster)
Cut-Pursuit Algorithm for Regularizing Non smooth Functionals with Graph Total Variation.
 - RFIAP, ENSG, France.
Large-scale Point Cloud Semantic Segmentation with Superpoint Graphs.
 - CVPR, Salt lake City, USA. (poster)
Large-scale Point Cloud Semantic Segmentation with Superpoint Graphs.
 - IGN Research Conference, ENSG, France.
Large-scale Point Cloud Semantic Segmentation with Superpoint Graphs.
 - SIAM symposium in Bologna, Italy. (invited talk)
Cut Pursuit for Optimizing with Graph-Structured Regularizers.
 - NoMADS, Politecnico di Milano, Italy. (invited talk)
Cut Pursuit for Optimizing with Graph-Structured Regularizers.
 - FOSS-4G, ENSG, France.
Presentation of the SuperPointGraph Repository.
- 2017** • IGN, France. (organizer)
Deep Learning for 3D Point Clouds.
 - Polytechnique Data Science Summer School, France. (poster)
Structured Optimization for Remote Sensing Applications.
 - IGN Research Conference, France.
Structured Optimization for Remote Sensing Applications.
- 2016** • GDR ISIS, Paris, France.
 ℓ_0 -cut pursuit algorithm for graph-structured greedy optimization.
 - AISTATS, Cádiz, Spain. (poster)
Cut Pursuit: Fast Algorithms to Learn Piecewise Constant Functions.
- 2015** • UAI, Quebec City, Canada. (poster)
Continuously Indexed Potts Models.

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Supervision and Community

Supervision

3 Interns: Stephane Guinard, Simon Bailly, Omar Lahbib.

4 PhDs: Stephane Guinard, Vivien Sainte Fare-Garnot, Mohamed Bous-saha, Raphael Sulzer.

Organization

- Organizer of the 2019 Conference on IGN Research, 250+ participants.
- Organizer of the STRUDEL reading group on machine learning for remote sensing, 6 presentations / years, 30-40 participants.
- Organizer of the *Deep Learning for 3D Point Cloud* Seminar at IGN, 25 participants.

Reviewing

I review or have reviewed for: ICML, NIPS, ICCV, CVPR, IJDSA, ANR Grants, ISPRS, and others.

Projects

I am a participant of the BIOM ANR Project.

Skills

Machine learning

- functional optimization
- deep learning
- LiDAR data
- Superspectral Imagery
- graphical models
- signal processing
- graph theory
- Time-sequences

Computer science

- C++
- Matlab
- Python
- PyTorch
- OpenMP
- Tensorflow
- Java
- \LaTeX