

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**GitHub:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

# 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 optimization and learning algorithms leveraging the structure of real-life problems (spatial, temporal, spectral, or multi-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

- 2020 - present : ENSG, *Course Instructor*  
Deep Learning for Remote Sensing (9 hours).
- 2020 - present : ENSG, *Course Instructor*  
Introduction to Machine Learning (6 hours).
- 2019 : AIMS, Master AMMI, Kigali, Rwanda, *Teaching assistant*  
Probabilistic Graphical Models (2 weeks intensive course).
- 2019-2020 : EUROSADR with EduSERV, *Course instructor*  
Deep learning for remote sensing (2 week intensive course).
- 2019 : ENPC, Master IMI, *Teaching assistant*  
Introduction to machine learning (9 hours).
- 2017–2019 : ENSG, Master PPMD, *Course instructor*  
Structured classification (6 hours).
- 2016–2017 : ENSG, Master DesiGeo, *Course instructor*  
Introduction to machine learning (18 hours).
- 2014 : ENS Cachan - Master MVA, *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.

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**Github:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

**2011 - 2012, ENPC ParisTech, MSc**

Master IMI, computers science and applied mathematics.

**2007 - 2011, Ecole Polytechnique, MSc**

Algorithmic and applied mathematics.

## Main 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*.
- **2020, Photogrammetric Engineering & Remote Sensing:** Sébastien Giordano, Simon Bailly, Loic Landrieu, Nesrine Chehata, *Improved Crop Classification with Rotation Knowledge using Sentinel-1 and-2 Time Series*.

### Conferences

- **2020, 3DV (oral):** *Torch-Points3D: A Modular Multi-Task Framework for Reproducible Deep Learning on 3D Point Clouds*, Thomas Chaton, Nicolas Chaulet, Sofiane Horache, Loic Landrieu
- **2020, AALTD@ECML-PKDD:** Vivien Sainte Fare Garnot, Loic Landrieu, *Lightweight Temporal Self-Attention for Classifying Satellite Image Time Series*.
- **2020, CVPR (oral):** Vivien Sainte Fare Garnot, Loic Landrieu, Sébastien Giordano, Nesrine Chehata, *Satellite Image Time Series Classification with Pixel-Set Encoders and Temporal Self-Attention*.
- **2019, ICML Workshop:** Loic Landrieu and Mohammed Boussaha, *Supervised Segmentation with Graph-Structured Deep Metric Learning*.
- **2019, ICML Workshop:** Hugo Raguét and Loic Landrieu, *Parallel Cut Pursuit For Minimization of the Graph Total Variation*.
- **2019, IGARSS:** Vivien Sainte Fare Garnot, Loic Landrieu, Sébastien 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:** Stéphane 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*.

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**Github:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

- **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 [github.com/loicland](https://github.com/loicland), with several open-source repositories:

- [] [loicland/superpoint-graph](https://github.com/loicland/superpoint-graph) 516 ★ 155 🗨
- [] [loicland/cut-pursuit](https://github.com/loicland/cut-pursuit) 47 ★ 16 🗨
- [] [loicland/point-cloud-regularization](https://github.com/loicland/point-cloud-regularization) 28 ★ 12 🗨

I also participated in the following open-source project as advisor:

- [] [/nicolas-chaulet/torch-points3d](https://github.com/nicolas-chaulet/torch-points3d) 886 ★ 135 🗨
- [] [/VSainteuf/pytorch-psetae](https://github.com/VSainteuf/pytorch-psetae) 58 ★ 12 🗨

## Talks in Conferences and Invited Talk

oral keynote tutorial poster organising

**2021**

- CVPRW Earth Vision**, virtual, co-organizer  
Leading remote sensing workshop.

**2020**

- 3DV**, virtual, oral presentation  
Torch-Points3D: A Modular Multi-Task Framework-for Reproducible Deep Learning on 3D Point Clouds.
- AALTD**, virtual, poster  
Lightweight Temporal Self-Attention for Classifying Satellite Image Time Series.
- CVPR**, virtual, oral presentation  
Satellite Image Time Series Classification with Pixel-Set Encoders and Temporal Self-Attention.
- Conference on IGN Research**, virtual, oral presentation  
Deep Learning for 3D Analysis.
- Conference on IGN Research**, France, organizer  
Theme: AI and Spatial Information.
- EuroSDR** Marne-La-Vallée, France, lecturer  
Deep Learning for Remote Sensing.
- Quant Cube Technology** Paris, France, invited talk  
Recent Advances in Large-Scale Learning for Remote Sensing.

**2019**

- Norwegian Institute of Bioeconomy Research** Oslo, seminar  
Machine Learning and Deep Learning for Practitioners.
- 2nd International Workshop Point Cloud Processing**, Stuttgart, keynote  
Superpoint-Based Methods for 3D Point Clouds Analysis.
- Valeo.ai Research**, Paris, invited talk  
Superpoint-Based Methods for 3D Point Clouds Analysis.

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**Github:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

-  **Journées Nationales de la Recherche en Robotique**, France, keynote  
Deep Learning for Point Cloud Semantic Segmentation.
-  **ICML Graph Reasoning Workshop**, Long Beach, USA, poster  
Supervised Segmentation with Graph-Structured Metric Learning.
-  **ICML Graph Reasoning Workshop**, Long Beach, USA, poster  
Parallel Cut Pursuit For Minimization of the Graph Total Variation
-  **CVPR**, Long Beach, USA, poster. Point Cloud Oversegmentation with  
Graph-Structured Metric Learning.
-  **CVPR 3D Scene Understanding Workshop**, Long Beach, USA Point  
Cloud Oversegmentation with Graph-Structured 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.
-  **Facebook AI Research**, Paris, invited talk  
Optimization and Learning with Graph Sparsity
-  **JURSE 2019**, Vannes, France, tutorial  
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  
Theme: Temporal Data Analysis
-  **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** by DTU and DIKU,  
Copenhagen, lecturer
-  **ICML**, Stockholm, Sweden, poster  
Cut-Pursuit Algorithm for Regularizing Non smooth Functionals with  
Graph Total Variation.
-  **RFIAP**, ENSG, France, oral  
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, oral  
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, oral  
Presentation of the SuperPointGraph Repository.

## 2017

-  **IGN**, 3D Analysis Symposium, 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, oral  
Structured Optimization for Remote Sensing Applications.

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**Github:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

## 2016

 **GDR ISIS**, Paris, France, oral  
 $\ell_0$ -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.*

## Supervision and Community

### Supervision

In **bold**, current students.

- 10 Interns: Stephane Guinard, Simon Bailly, Omar Lahbib, Joana Rousillon, Thomas Luo (Helix.Re), Anna Kondracka (Vermessung AVT), Lamiae El-Mendili, Paul-Alexandre Nasr, Ameer Zaibi, **Julien Baconat**.
- 6 PhD Students : Stephane Guinard, Mohamed Boussaha, **Raphael Sulzer**, **Vivien Sainte Fare-Garnot**, **Damien Robert**, **Romain Loiseau**.
- 1 Post-Doc: **Ekaterina Kalinicheva**.

### Organization

- I am in the organizing committee of Eath Vision, a leading CVPR workshop.
- Organizer of the 2020 Conference on IGN Research, Theme: AI and Spatial Information, 800+ participants (virtual).
- Organizer of the 2019 Conference on IGN Research, theme: Temporal Data Modelling, 250+ participants.
- Organizer of the STRUDEL reading group on machine learning for remote sensing, 6 presentations / years, 20-30 participants.
- Organizer of the *Deep Learning for 3D Point Cloud* Seminar at IGN, 25 participants.

### Reviewing

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

I am on the reviewing committee of Remote Sensing and guest-editor for the special issue 'Multi-Modal Learning in Photogrammetry and Remote Sensing' of IJSPRS.

### Projects and Grants

- I am the investigator of the ANR JCJC Grant **READY3D**: REal-Time Analysis of DYnamic LiDAR 3D Point Clouds (total cost: 476k€, 194k€ subsidy).
- I am a participant of the **BIOM** ANR Project: Building Inside/Outside Modelling (total cost: 1 776k€, 723k€ subsidy).
- PHD financing from DGA to hire Stephane Guinard, with Bruno Vallet (100k€ subsidy).
- Financing from AFP, including a PhD position for Vivien Sainte-Fare Garnot, with Sébastien Giordano (300k€ subsidy)
- Joint PhD between ENGIE, IGN and Univ. Paris Est (250k€ budget).

Loic Landrieu

**Email:**

loic.landrieu  
@ign.fr

**Website:**

loiclandrieu.com

**Github:**

loicland

**ORCID:**

0000-0002  
7738-8141

**Phone number:**

(+33)6 77 18 92 53

50 rue du  
Capitaine Marchal  
Paris, 75020  
France

## Industry

- I am a Scientific Advisor for the company SAMP ([samp.ai](http://samp.ai)) which does *digital twins* of industrial facilities from LiDAR data.
- I do technical consulting for companies who wants to apply our methods to their production line. Notable clients: Helix.Re ([helixre.com](http://helixre.com)), Gambi-M ([gambi-m.com](http://gambi-m.com)).

## 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
- L<sup>A</sup>T<sub>E</sub>X

### Langage

**French:** Native speaker.

**English:** Fluent (TOEFL IBT 112, TOEIC 990), native speaker wife.

**German:** (Very) limited working proficiency.