

Summer school 2023 Environmental point clouds classification	12-15 June Rennes, France	Ver 0.2 1 / 4
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Day 1 13 June	08h30-09h00	<i>Welcome, coffee</i>
	09h00-09h30	General introduction, tour de table
	09h30-10h30	Presentation of 10 participants
	Machine learning approach: classification with CloudCompare (3DMASC) M. Letard, P. Leroy	
	10h30-12h00	Basics of machine learning Presentation of 3DMASC: a simple approach to machine learning with random forest Properties of good training / test datasets
	-----	<i>Lunch</i>
	13h30-14h30	Presentation of 10 participants
	14h30-16h00	Compute / visualize features with CloudCompare Show limitations of available features Build parameters files for 3DMASC Compute features with 3DMASC (train) Explain how to read a confusion matrix
	-----	<i>Pause</i>
	16h15-17h30	Introduce random forest: prediction confidence, feature importance Go through available metrics, their uses and limitations Explain feature selection using the GUI
	17h30-18h00	Presentation of 5 participants [3]
-----	<i>Diner 19h00 (Loco Loca, Rennes)</i>	

Summer school 2023 Environmental point clouds classification	12-15 June Rennes, France	Ver 0.2 2 / 4
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Day 2 12 June	08h30-10h30 M. Letard P. Leroy	Manual data labelling using CloudCompare Process various datasets (personal data or other files proposed by the team)
	-----	<i>Pause</i>
	Machine learning approach: point-cloud classification with Python	
	10h30-12h00 M. Letard P. Leroy	How to compute 3DMASC features out of the GUI and use them in Python OpenCV: introduce possibility to train with Python and classify with CloudCompare Scikit-learn: application of random forest and other algorithms to the labelled data with 3DMASC features Compare metrics obtained
	-----	<i>Lunch</i>
	13h30-15h30	Introduce advanced feature selection with Python SHAP (Shapley Additive exPlanations)
	-----	<i>Pause</i>
	Classical methods (geometrical, rule-based approaches)	
	15h30-17h30 B. Bookhagen	LiDAR based metrics (intensity, return number, number of returns, naïve classification, rule-based) Introduction to commonly used software for ground classification <ul style="list-style-type: none"> • PDAL (Point Data Abstraction Library) • LAStools • CloudCompare CSF plugin (cloth simulation) Application (command line, Python) to an ALS dataset of Berlin
	-----	<i>Diner 19h00 (La Motte Picquet, Rennes)</i>

Summer school 2023 Environmental point clouds classification	12-15 June Rennes, France	Ver 0.2 3 / 4
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Day 3 14 June	08h30-10h15 B. Bookhagen A.Rheinwalt	<p>Applications on labelled datasets: ALS, TLS, SfM</p> <ul style="list-style-type: none"> • ALS University campus Rennes • ALS + SfM mountains • TLS dataset (salt marshes + river gorge) <p>Show limitations of classical tools on steep environments or dense vegetation, or SfM data with vegetation</p>
	Neural networks approach	
	10h30 – 12h00 T. Corpetti	Low level introduction to deep learning concepts
	-----	<i>Lunch</i>
	13h30-14h30 <i>Invited</i>	<p>Aljoscha Rheinwalt [University of Potsdam] Philippe Steer [University of Rennes] <i>Pebbles segmentation</i></p>
	-----	<i>Pause</i>
14h45-17h30 A. Rheinwalt B. Bookhagen	<p>Classification with a neural network (Multi-Layer Perceptron) and Random Forest</p> <ul style="list-style-type: none"> • Large training dataset in a mixed urban-vegetation environment and classes ground, building, vegetation, cars • Using python-tensorflow and scikit-learn • Neural network and Random Forest parameters 	

Summer school 2023 Environmental point clouds classification	12-15 June Rennes, France	Ver 0.2 4 / 4
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Day 4 14 June	09h15-12h00 B. Bookhagen A. Rheinwalt	Concepts of 2D convolutional neural networks Practical, using LiDAR data to prepare data for 2D convolutional network (trees) Google Colab or direct use of Python (depending on computing resources needed for the practical)
	-----	<i>Lunch</i>
	13h30-14h00	Satisfaction survey, tour de table P. Leroy
	14h00-15h00 <i>Invited</i>	Loic Landrieux [IGN] <i>Deep learning on point clouds</i>
	15h00-16h00 <i>Invited</i>	Charles Gaydon [IGN] <i>LiDAR HD french national LiDAR cover classification workflow</i>
	16h00-17h00 <i>Invited</i>	Mathilde Letard [University of Rennes] <i>Deep learning on waveforms</i>
	-----	<i>Picnic on the beach, departure from the campus at the end of the day!</i> <i>(Food included)</i>