HT5 - Measuring 1.30 m diameter automatically

fr_FR.png ...version française de cette page

This tutorial uses the following script in the Computree HowTo subfolder: HT5_Measuring_DBH_automatically.xsct2

Objectives

This tutorial shows how to :

- 1. Automatically detect individual tree stems, tree positions and diameters at breast heigh (DBH) from terrestrial laser scans (TLS)
- 2. Understand and configure steps' parameters
- 3. Export results attributes to .csv file

Load data

Please refer to tutorial HT1 - Load, visualize, crop and export a T-Lidar point cloud at the Load a ploint cloud section.

For best results, use multiple scans. Stem detection is highly affected by data quality! We seek to maximize objects' reprensation and minimize occlusion in the point cloud.

Plot extraction (optional step)

Please refer to tutorial HT1 - Load, visualize, crop and export a T-Lidar point cloud at the Plot extraction section.

Points density reduction (optional step)

The PB_stepReducePointsDensity step is found in the base plugin (base / Points clouds / Points density reduction).

If you are using multiple scans, it is recommended to add a step for point density reduction to decrease calculation time. Depending on your computer performances, a 0.5 or 1 cm **Grid resolution** should be fine.

A high resolution point cloud (a large number of points per cubic centimeter) increases the calculation time.

Configuration (PB_St	epReducePo	ointsDensity (103))	ନ୍ତ	23
Resolution of the grid:	1.000	💼 cm		
		ОК	Cano	el

Ground / vegetation separation

Please refer to tutorial HT2 - Create a Digital Terrain Model from a T-Lidar point cloud.

Horizontal clustering

The OE_StepHorizontalClustering04 step is found in the onfensamv2 plugin (onfensamv2 / Clustering by horizontal slices)

Make sure that the input results are Vegetation points! To access this window right click on the step and select Config. input results

horizontal_clustering_input_EN.jpg

This step creates horixontal clusters. The scene is divided in horizontal layers of a specified Thickness. Then, for each layer, points

are gathered in clusters according to the distance between them. The **Maximum distance between two points of the same group** must be indicated.



Results of the horizontal clustering:

Each color represents an individual cluster.



Cluster filtering

The OE_StepFilterClustersBySize step is found in the onfensamv2 plugin (onfensamv2 / Filtering of clusters by points number)

This step filters undersized clusters. Clusters with a number of points strictly lower than the Minimum points number are eliminated.

The point cloud resolution and the horinzontal layers' thickness from the previous step influence this parameter. If the number of points per cubic centimeter is low and the layers are thin, the number of points per cluster will be low from the beginning.

Configuration (OE_StepFilterClusters		23
Minimum points number in one cluster 4	×	pts
ОК	Canc	el

Merge clusters in logs

The OE_StepDetectSection07 step is found in the onfensamv2 plugin (onfensamv2 / Vertical merging of clusters in logs)

This step vertically aggregates clusters in sections (logs). A **Vertical distance threshold** is indicated to compare clusters in pairs. If both clusters' bounding boxes intersect on that distance threshold, clusters are merged. A log stops when there is a vertical break in the cluster. Scan occlusions or presence of a branch are commun causes.

Configuration (OE_StepDetectSection07 (1	137))	8 23
Maximum Z distance (+ or -) between 2 points	dusters to compare 10	0.00 🚖 cm
	ОК	Cancel

Results of the clusters merging in logs:

Each color reprensents an individual log.



Filter logs

The *OE_StepFilterGroupsByGroupsNumber* step is found in the *onfensamv2* plugin (*onfensamv2* / *Filtering lvl 1 groups* / *number* of *lvl 2 groups*)

This generic method removes groups (logs) that have a poor number of subgroups (clusters). Level 1 groups (logs) are eliminated if they got an insufficient **Level 2 number of groups** (clusters). This step is used to clear most of the small branches and false logs.

Configu	ration (O	E_StepFilte	rGroupsE	lyGroups	Nu 8	×
Minimum	number of	Ivl 2 groups	in a Ivi 1	group 4	🔶 gre	oupes
				OK	Can	icel



Merge neighbour sections

The OE_StepMergeNeighbourSections04 step is found in the onfensamv2 plugin (onfensamv2 / Merging of parallel logs)

This step merges adjacent logs. When there is occlusion in the point cloud, branches can be cut so that two logs are created instead of one:



First, all clusters of a log are recreates according to a specified **Thickness (in Z)**. Then, logs belonging to the same tree are merged. This tool takes the following parameters:

- The Search distance for neighbours parameter is used for calculation optimization.
- The Maximum XY distance between cluster's barycenters. If the horizontal distance between compared barycenters is greater than this parameter, logs will not be merged.
- The Maximum Z distance between cluster's centroid. If the vertical distance between compared barycenters is greater than this parameter, logs will not be merged.
- The **Maximum inscreasing factor** is used so that the merge does not create too much distance between the new barycenter and cluster points. An increasing factor of 2 means that the distance between the new barycenter and cluster points can be doubled.

Configuration (OE_StepMergeNeighbourSections04 (139))		ବୃ	23
Z-thickness of clusters:	10.00	*	cm
Distance for neighbourood search:	10.00	(A) (V)	m
Maximum XY distance between barycenter of clusters for logs to merge:	50.00	×	cm
Maximum Z distance between barycenters of clusters for logs to merge:	20.00	*	cm
Maximum increasing factor for XY distances between barycenters of cluster for logs to merge:	1.50	*	times

Merge aligned logs

The OE_StepMergeEndToEndSections04 step is found in the onfensamv2 plugin (onfensamv2 / Merging of aligned logs)

This step merges logs that are aligned in direction. The step operates this way (see also the technical diagram below):

- Clusters are recreated with the specified Z-thickness of groups
- Logs are then compared in pairs. If the distance between two logs is lower than the Maximum distance, logs can be merged.
- Imaginary lines between each log's clusters are created. The Number of barycenters to consider must be specified.
- The maximal distance between the line and the end of the first log is calculated (maxDist). The distance between the first log's line and the second log's line must not be higher than maxDist * a **Multiplicative factor**.
- A Tolerated Z overlapping is also specified.

Z-thickness of groups:	10.00	*	cm
Maximum distance beetween extremities of logs to merge:	1.00	*	m
Number of barycenters to consider at extremities:	10	*	
Multiplicative factor for maxDist:	2	*	
Tolerated Z overlapping:	20	*	cm

Technical diagram:





No fusion

Results of the fusion:

You can notice an exemple of vertical overlaping on the left image.



Set coordinates

The *OE_StepSetFootCoordinatesVertically* step is found in the *onfensamv2* plugin (*onfensamv2* / *Addition od a base coordinante by log* // *DTM*)

This step takes two input results: the Digital Terrain Model and the Merged logs!

Results names	Description	Step	Tour 1 +	
 DTM (raster) 	DTM (raster)			
Digital Terrain Model	Digital Terrain Model	OE_StepExtractSoil03 (91)	Resultats names Step	
Digital Surface Model	Digital Surface Model	OE_StepExtractSoil03 (91)	 DTM (raster) 	
Digital Height Model	Digital Height Model	OE_StepExtractSoil03 (91)	Digital Terrain Model OE_StepEx	tractSoil03 (91)
4 Logs	Logs		▲ Logs	
Merged logs	Merged logs	OE_StepMergeEnd loEndSections04 (97)	Merged logs OE_StepM	ergeEndToEndSections04 (97)
			OutputfromOE_StepExtractSoil03 (91)	Selection Input
			OutputfromOE_StepExtractSoil03 (91)	Selection Input
			a digital lerrain Model	21
			DTM (raster)	V
			L	

There are no parameters needed. This step sets coordinates for tree positions by projecting the lowest cluster on the MNT.

Fit and filter cylinders

The OE_StepFitAndFilterCylindersInSections step is found in the onfensamv2 plugin (onfensamv2 / Fitting / Filtering of cylinders by log)

This step creates cylinders and filters them depending of their goodness of fit. The tool requires a **Minimum radius** and **Maximum radius** so that small or large trees are not represented. Cylinders can be filtered on the **Absolute error** and/or the **Relative error**. They also can be filtered on their verticality, a **Maximum vertical angle from solar zenith** must be specified.

Minimum radius:	2.00	cm
Maximum radius:	80.00	cm
	Filter cylinders on absolute error	
Maximum error:	4.00	cm
	Filter cylinders on relative error	
Maximu <mark>m</mark> relative (to diameter) error:	30.00	%
	Filter cylinders on verticallity	
Maximum angle from vertical (zenithal angle):	30.00	۰

Results of the cylinder fitting:



Compute cylinders diameter

The *OE_StepExtractDiametersFromCylinders* step is found in the *onfensamv2* plugin (*onfensamv2 / Computing of cylinders mean diameter by log*)

This tool compute trees' diameter at breast height (DBH). In order to do that, a cercle is adjusted on a previously created cylinder. A **Bottom height** and a **Top height** for evaluation are specified. Cercles radii are calculated between these values in order to calculate a regression. The **Reference height** value (generally 1.30 meters) is interpolated of this regression. The **Maximal taper** is used to insure that no abberant cylinders are used in the calculation. A **Minimum number of cylinders to adjust a circle** is also specified.

Reference height:	1.30	.A. 	m
Bottom height for evaluation:	1.00	×	m
Top height for evaluation:	1.60	×	m
Maximal taper:	5.00	*	cm
Minimum number of cylinder to adjust a circle:	3	*	

Results visualization

To visualize the adjusted cercles , you must activate the results in the Step and Model managers.

tep manager					8 3
Name	- ×	Progress	Time / Show	Deb	• •
	 OE_StepMergeEndToEndSections04 (97) 	100%	0h:0m:0s:979ms	0	
	Merged logs	100%			
	 OE_StepSetFootCoordinatesVertically (98) 	100%	0h:0m:0s:19ms	0	
	Merged logs (COPY)	100%			
	 OE_StepFitAndFilterCylindersInSections (99) 	100%	0h:0m:0s:58ms	0	
	Merged logs (COPY)	100%			
	 OE_StepExtractDiametersFromCylinders (100) 	100%	0h:0m:0s:23ms	0	
	Merged logs (COPY)	100%			=
	Attributs/Items d'un groupe	100%	0h:0m:0s:361ms	0	
Merged logs (COPY) (OE_StepExt	tractDiametersFromCylinders (100))			•	0
Name	1				
Merged logs					
Log (Grp)					
 Cluster (Grp) 					
Points					
Barycenter					
Cylinder					
DTM coordinate					
Diameter at 1.30 m					

A simple right click on <u>Diameter at 1.30m</u> enables you to change the cercles color.

To visualize the results attributes, activate 1 Information ItemDrawable in the Action tab and then select an object.



Export attributes

The PB_CSVExporter step is found in the base plugin (base / Exporters / Export d'attributs (csv))

First, select the input result.

Results names	Description Step	Tour 1		
Result	Result			
Merged logs	Merged logs OE_StepExtractDiametersFromCylinders (100)	Resultats names Step		
		▲ Result		
		Merged logs OE_StepExtractDiametersFromCylinders	(100)	
		OutputfromOE_StepExtractDiametersFromCylinders (100) Merged logs 	Selection	Input
		Log (Grp)		Groupe
		Points		Item
		Barvcenter		Item
		Cylinder		Item
		DTM coordinate		Item
		Diameter at 1.30 m	V	Item

Then, drag and drop attributes you wish to include in the file.

		ID	Centre X	
 Diameter at 1.30 m ID 	1			
Centre X				
Centre Y				
Centre Z				
Rayon du cercle				
Erreur d'ajustement du cere				
•				

Finally, specify the path and file name.

) 🔾 🔋 🖡 🕨 computree_64bi	ts ▶ HowTo ▶ output	▼ 4 ₂	Rechercher dans :	output 🚽
Organiser 🔻 Nouveau dossie	er			III • 🕡
🖈 Favoris	Nom	Modifié le	Туре	Taille
🧮 Bureau	HT5_export_1_Billon (Grp)	2014-12-11 10:15	Document texte	33 k
🔚 Emplacements récents 😑	HT5_export_1_Log (Grp)	2014-12-11 15:10	Document texte	33 I
🗼 Téléchargements	HT5_export_2_Cluster (Grp)	2014-12-11 15:10	Document texte	384 8
 Bibliothèques Documents Images Musique 				
Videos -		III		
Nom du fichier : HT5_export				
Type : TXT Files (*.t	xt)			
Cacher les dossiers		ſ	Enregistrer	Annuler

If you are using a script, right click on <u>Attributs/Items d'un groupe</u> and then select <u>Config. input results</u> to specify the attributes and <u>Config. parameters</u> to specify the file name.

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