SimpleTree Plugin

The SimpleTree plugin is developed by Jan Hackenberg the DIABOLO project ([[http://diabolo-project.eu/]]) - working package (WP) 2.2.2

DIABOLO has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633464.
Working package 2 has the generale purpose of Harmonizing growing stack, biomass and carbon estimation.

Output of the plugin...
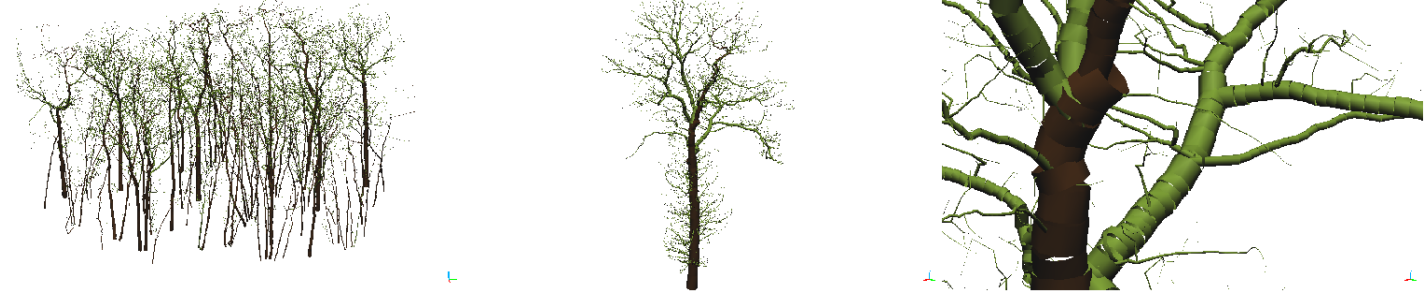
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Files

| all_pics.png | 194 KB | 08/18/2017 | Hackenberg Jan |

Changelog SimpleTree 4 - all Beta Versions summary

Changelog:

- **Beta_32 to Beta_33.06**:

  - Fixed a bug in DTM
  - switched standard allometric correction approach to Xu et al.
  - Fixed a bug in statistical outlier filtering
  - Lisence added and opening of source code

- **Beta_31 to Beta_32**:

  - Adjustment of steps input and output configuration

- **Beta_30 to Beta_31**:

  - Change in the allometric scaling correction approach

- **Beta_28 to Beta_30**:

  - Change in the parameter optimization

- **Beta_21 to Beta_28**:

  - Bugfix in Segmentation. Should work better now
  - Bugfix in DTM modelling
  - Prevented some crashes in filtering where empty clouds were produced.
  - Added an exporter for ascii 1 file / scene. You can also export the segmented tree clouds directly in my exporter step.
  - Added an exporter for DTM to ply

- **Beta_17 to Beta_21**:

  - Improved the Segmentation runtime. It is down to 2 minutes for some test plots.
  - Added a SimpleTree DTM step
  - Improved few Dialogs
  - Added a low quality option for the segmentation
  - Made step optional (Upscaling, if number iteration set to 0)

- **Beta_15 to Beta_17**:
  my final version of my project pipeline. Final does not mean single steps do not get improved anymore, 2 steps even might still be replaced. Regarding the input and output of the pipeline though nothing changes. Fixed a lot of bug and improved both modelling as well as segmentation. Two more dedicated de-noising steps which had been removed are readded. Take those with care, they are quite untested.
- **Beta_14 to Beta_15**:
  fixed a bug where cut_height was computed correctly but not used for DBH, height and length computation. All three parameters should now be usable.
- **Beta_10 to Beta_14**:

  - Major fit quality improvement, also improved modelling of young trees.
  - No change to the output csv format to be downward compatible regarding further analysis
  - Added a few steps to make plot level analysis more comfortable. There is one step included which can get rid of segmented undergrowth for example.
  - For users who work on plot level, outputfiles which are created adapt their name from your plot cloud.
  - DBH is estimated by DTM, not from cutheight as user input. You do not have to give this value in an input file anymore.

- **Beta_07 to Beta_10**: added plot level processing tools. Improved fit quality. Fixed a lot of bugs. Added various output options. Video tutorials are contained as well.
- **Beta_06 to Beta_07**: several minor improvement procedures included and minor bug fixes implemented. Changed the user documentation also slightly.
- **Beta_05 to Beta_06**: added a lot of point cloud steps like de-noising. Fixed minor bugs and updated complete user documentation
- **Beta_04 to Beta_05**: improved the fit quality for all modellings.
- added test data

- **Todo**: output, input, tutorials, acknowledgements, release. std out filter should be multithreaded. transfer step for segmentation.

FAQ - Something went wrong

Message You need to utilize clouds with the prequesitions:

1. The center of the cloud is near the origin (max 50m), no georeferenced clouds allowed. No real world height allowed or at your own risk. The underlying point cloud library operates with float not doubles and point transformation tend to have therefore pretty fast floating point issues. Just follow this advice if you do not understand the reason ....
2. I reach good runtime for plots smaller than 40m. I know the segmentation time increases exponentially with the radius and running the pipeline on hectare sized plots seems impossible without manual interaction.
3. Beware if you try to model exotic trees (not expected in Euorpean NFI) I know buttress trees are expected to have issues with the underlying RANSAC principle during geometrical fitting.
4. Be aware to observe carefully if you model trees with points larger than ~20 mio points. PCL routines using an Octree can fail here.

I checked for the preconditions named at 1). SimpleTree steps still do not perform as expected or is crashing

1. Check if for each input result only one group is selected.
2. Save the input cloud as xyb
3. Produce a minimal running example with the test cloud which causes the crash or unpredicted behavior
4. Make a well formated forum post. You enrich the post with the saved script from 3) and the cloud from 2).

How to Install - Use

A precompiled Windows Version of SimpleTree plugin in Computree can be downloaded here:
http://rdinnovation.onf.fr/projects/computree-simpletree-beta-version/files

You find source code here:
http://rdinnovation.onf.fr/projects/plugin-simpletree/repository

This is the youtube tutorial channel:
https://www.youtube.com/channel/UCq2dqxUF3IGmusX0ptk7xhw

List of References

For utilizing TLS scans a QSM method has been adapted to work on plot level. The whole plugin was developed utilizing source code from an open source tool named SimpleTree ([[http://www.simpletree.uni-freiburg.de/]]). This standalone tool is unsupported since the core was integrated in the Computree platform. Still the mandatory citation for utilizing this plugin is:

- Hackenberg, J.; Spiecker, H.; Calders, K.; Disney, M.; Raumonen, P., *SimpleTree —An Efficient Open Source Tool to Build Tree Models from TLS Clouds.* , Forests **2015** , 6, 4245-4294.

Two earlier published manscripts exist as well, the second one is mandatory to cite also if you use the test data which was published there:

- Hackenberg, J.; Morhart, C.; Sheppard, J.; Spiecker, H.; Disney, M. *Highly Accurate Tree Models Derived from Terrestrial Laser Scan Data: A Method Description*. Forests **2014**, 5, 1069-1105.

- Hackenberg, J.; Wassenberg, M.; Spiecker, H.; Sun, D. *Non Destructive Method for Biomass Prediction Combining TLS Derived Tree Volume and Wood Density*. Forests **2015**, 6, 1274-1300.

Additionally from the following publication was adapted:

- Cote, J.F.; Fournier, R.A.; Egli, R.; *An architectural model of trees to estimate forest structural attributes using terrestrial LiDAR*. ;Environ. Model. Softw. **2011**, 26, 761-777.

To support the core team (Alexandre and Michael) of Computree the best peer-reviewed resource might be this, as it describes steps included in the pipeline:

- Ahlem Othmani, Alexandre Piboule, M. Krebs, C. Stolz, L.F.C. Lew Yan Voon; *Towards automated and operational forest inventories with T-Lidar*. 11th International Conference on LiDAR Applications for Assessing Forest Ecosystems (SilviLaser) **2011**, Hobart Australia.

In addition the plugin steps rely heavily on the point cloud library ():

- Radu Bogdan Rusu and Steve Cousins, *3D is here: Point Cloud Library (PCL)*. IEEE International Conference on Robotics and Automation (ICRA) **2011**, China Shanghai.

and the OpenCV library ([[http://code.opencv.org/projects/opencv/wiki/CiteOpenCV]]), which you might also want to use to give credit to the people working on those projects.

As soon as my crown segmentation algorithm and the advanced QSM method is published I will give you more citations. In case you submit a manuscript results produced with the plugin clearly mention the version of the release.