

### ABSTRACT

Two well known commercial Photogrammetry Software Suites, Agisoft Photoscan and Pix4D Pix4Dmapper have been compared to a Opensource product called Visual SFM with PMVS plugin. The Results showed about the same amount of point density for the two commercial products, with VSFM behind. The detail of rendering from Pix4D is inferior to Agisoft, especially in the term of roughness of the produced point cloud. A ground sampling distance of 2,5 cm has been estimated with Pix4D which is competitive to Lidar workflows.

### OBJECTIVE

The main objective of the project was to compare the output quality of different Software products based on the same input dataset. Quality was rated in terms of the local density of the point cloud, point distances compared to the other products and the roughness of the cloud, representing the modeling detail. Ease of use and the ability in Georeferencing was rated as well.

### METHOD

The input dataset consisted of 34 aerial images of an alpine riverbed in Obermieming / Tirol made from an UAV [flight height ~ 95m above ground] and 6 corresponding ground control points measured with differential GPS. A dense pointcloud has been produced in each case, using the integrated georeferencing tools as well.

The datasets have been imported to the Software CloudCompare to evaluate the quality of the output by comparing each result with the other ones.

### RESULTS

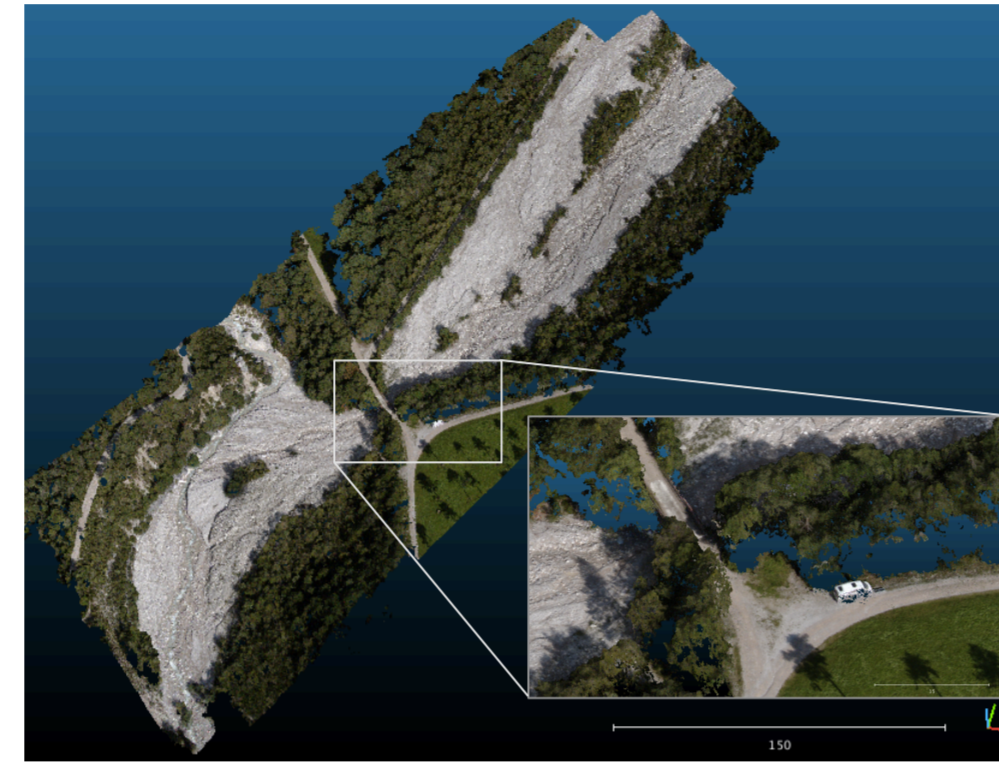


Fig. 1: Dense point Cloud from Agisoft Photoscan.

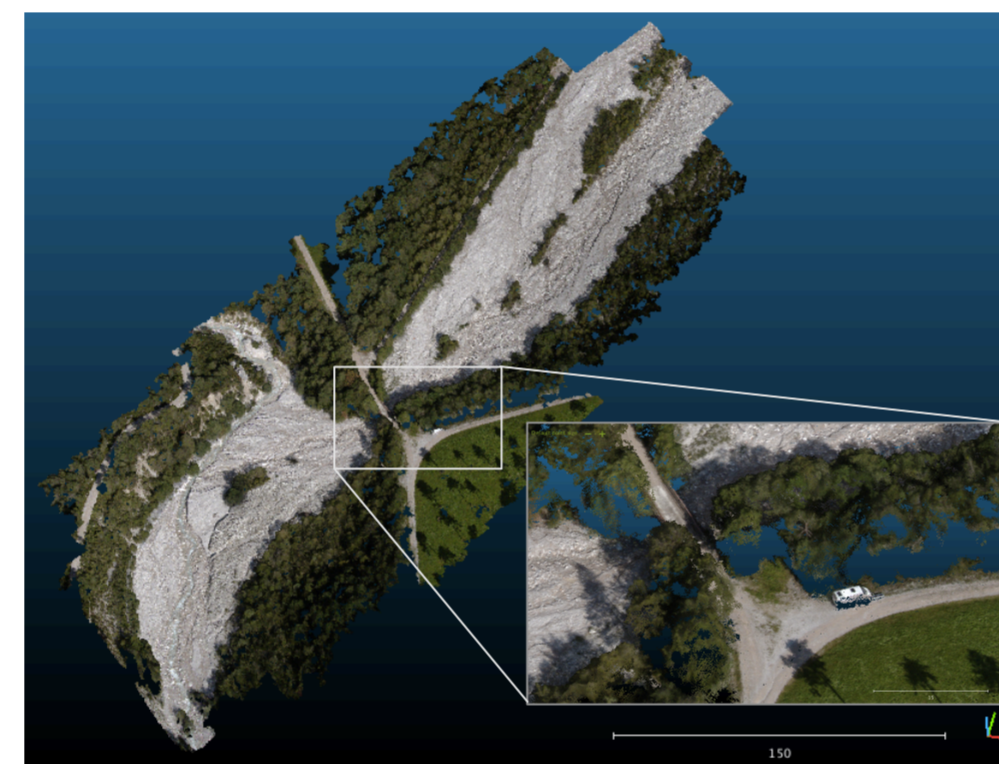


Fig. 2: Dense point Cloud from Pix4D Pix4Dmapper.

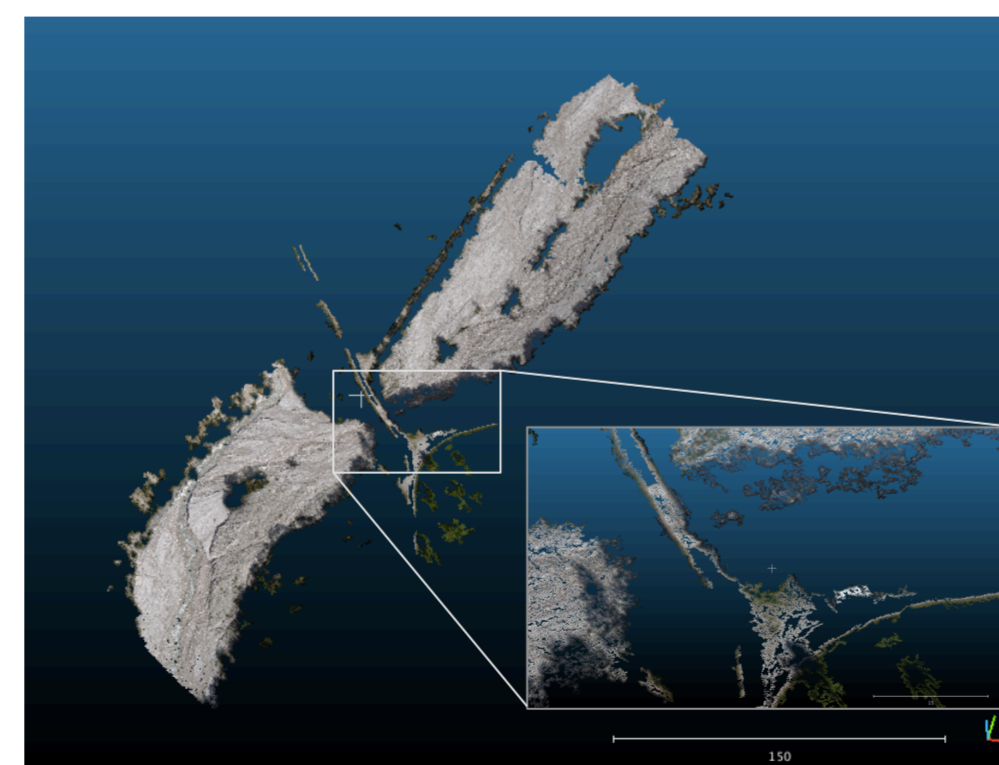


Fig. 3: Dense point Cloud from Visual SFM / PMVS.

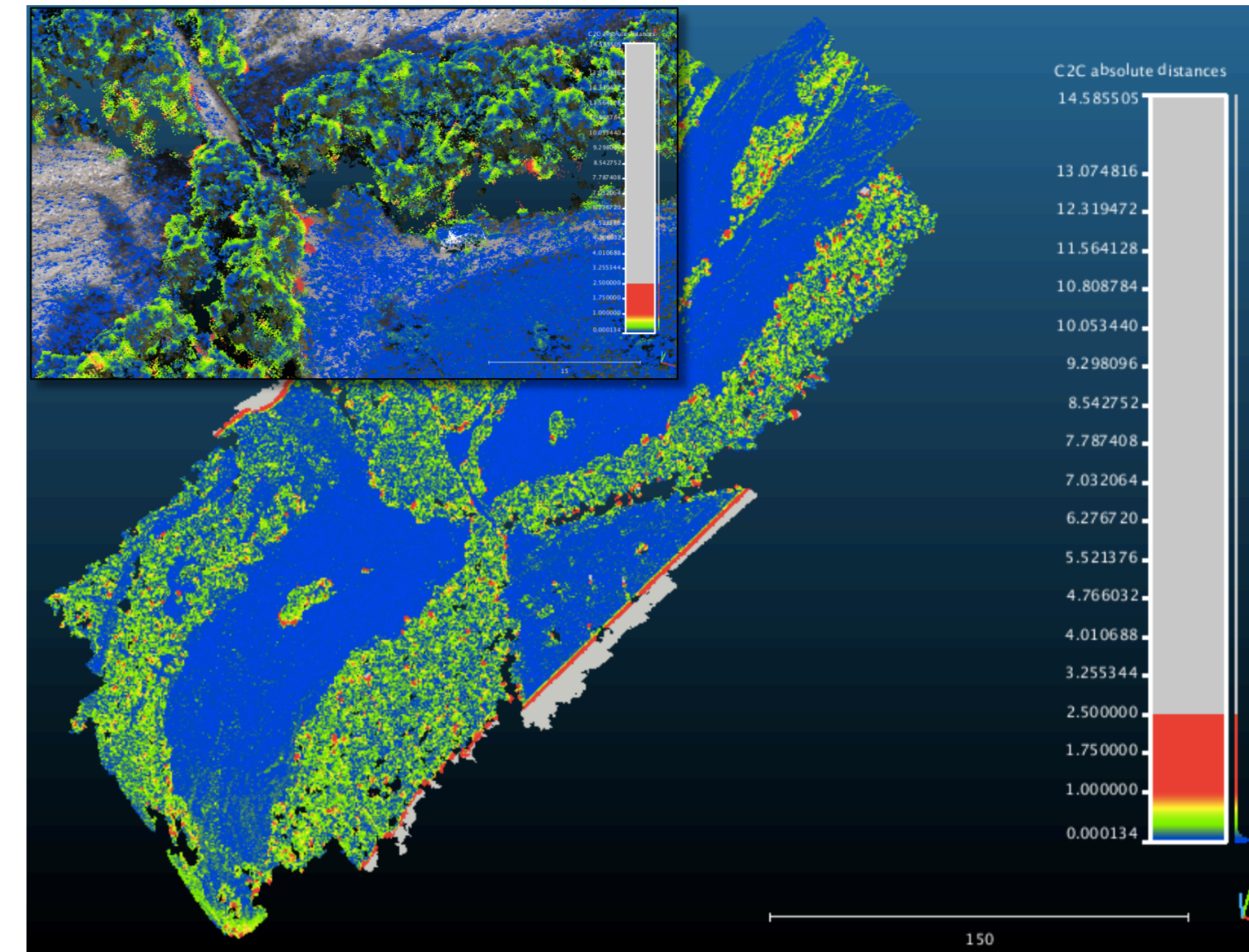


Fig. 4: Cloud to cloud distance from Agisoft and Pix4D, with detail view.

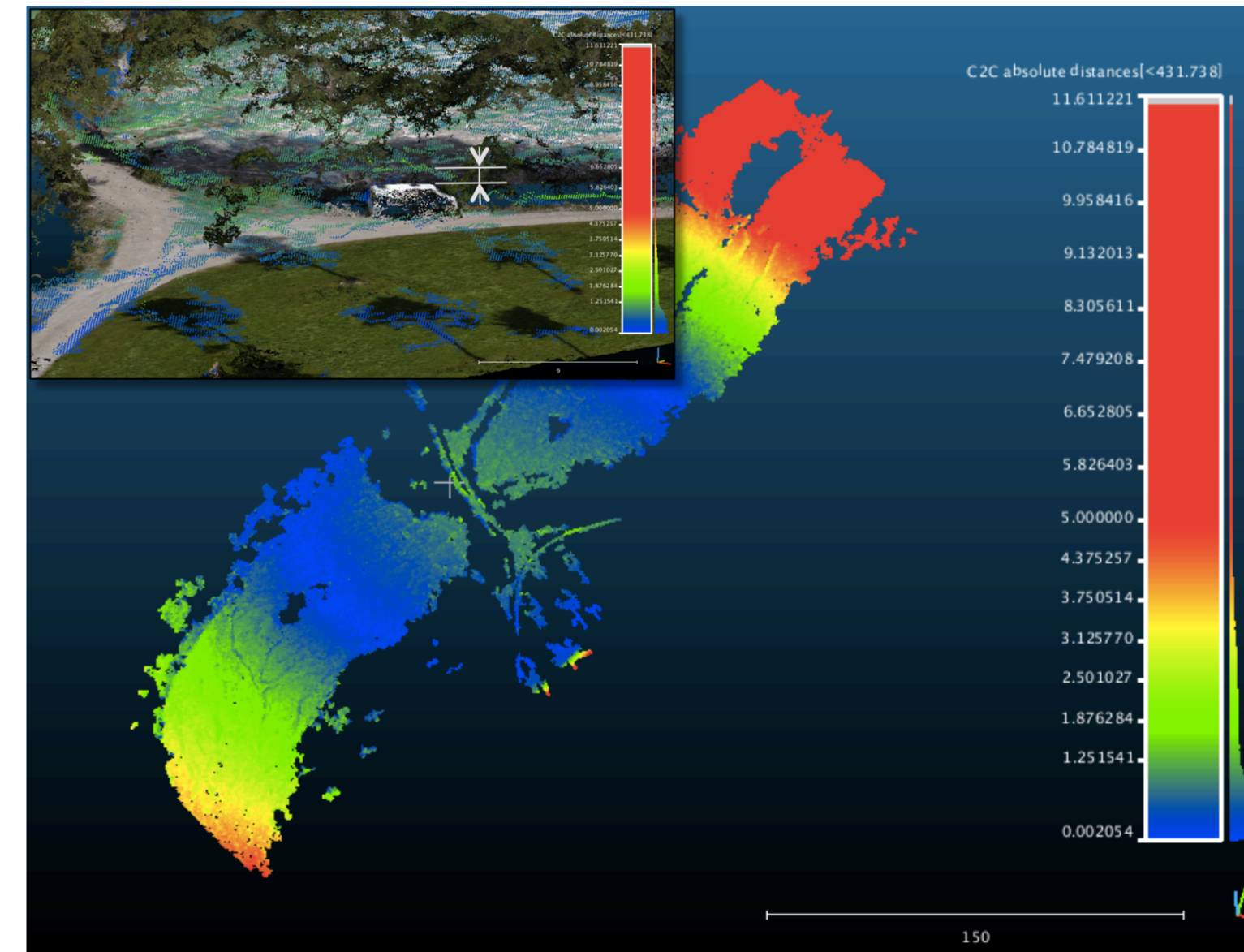


Fig. 5: Cloud to cloud distance from Agisoft and Visual SFM / PMVS. Detail: Distance of VSFM point cloud to Agisoft point cloud.

Fig. 1 – 3 show the resulting point clouds of the corresponding products. Agisoft and Pix4D modeled about the same extent, with better results in vegetated areas from Pix4D. VisualSFM did only model the unvegetated areas with unsatisfying results in the vegetated areas.

Fig. 4 shows overall the same quality of Agisoft and Pix4D in unvegetated area, while having greater differences in cloud to cloud distance in the vegetated areas (see Fig. 4 detail view.)

Fig. 5 shows problems of VSFM with accurate georeferencing in the detail view (the car roof is 1,5m too high), the main view visualizes a bending-failure of the whole model resulting in up to 10m to low height of the model at the upper end.

Fig. 6 shows overall better detail produced by Pix4D in terms of roughness in the riverbed.

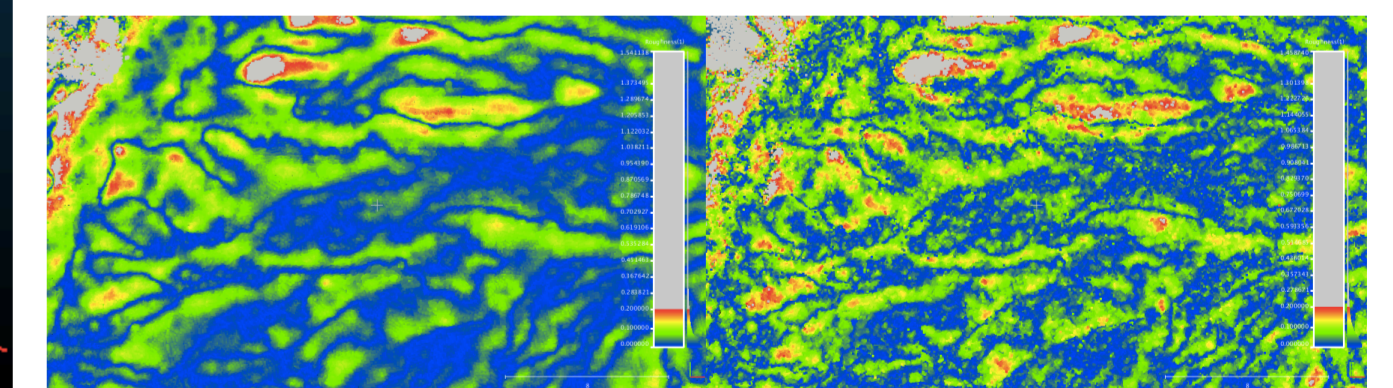


Fig. 6: Model Roughness of Agisoft (left) compared to Pix4D (right). (0m = blue to 20cm = red compared to 1m<sup>2</sup> surrounding best fitting plane)

	Agisoft	Pix4D	Visual SFM
Point Cloud [mio. points]	15,073	12,251	0,999
CPU time (Dual Xeon 2,8GHz - 32GB RAM) [min.]	55	70	85
Georeferencing	++	++	-
Rendering vegetation	+	++	-
Point to Point Distance	+	+	0
Roughness	+	++	-

### REFERENCES

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- Pix4D (2014): Pix4Dmapper. <http://www.pix4d.com>
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