## **Multi-scale Space-time Registration of Growing Plants**

Haolin Pan Shanghai Jiaotong University Sony CSL Paris haolin.pan@polytechnique.edu Franck Hétroy-Wheeler University of Strasbourg hetroywheeler@unistra.fr Julie Charlaix ENS Lyon ju.charlaix@gmail.com David Colliaux Sony CSL Paris koddda@gmail.com

## **Supplementary Material**

**Figures and Tables** Features used for learning are described in Tables 1 and 2. Figures 3, 4 and 5 show registration results on arabidopsis, maize and tomato plants. Other registration results for noisy scans are shown in Figure 1. Finally interpolation and tracking results are shown in Figures 6 and 2, respectively.

**Videos** Some examples of videos produced by interpolating point clouds of growing plants are provided.



(a) Arabidopsis (with noise, low resolution and segments randomly dropped)



(b) tomato plant (with strong noise and low resolution)

Figure 1: Registration result of our method on plants with low resolution/noise/acquisition failures. The correspondence is illustrated through colours and lines.

## References

[1] Tim Golla, Tom Kneiphof, Heiner Kuhlmann, Michael Weinmann, and Reinhard Klein. Temporal upsampling of point



(a) Tracking of the main stem length (mm). In blue is shown the measurement made using our framework, and in green is the manual measurement (ground truth).



(b) Tracking of the length of several branches (mm).

Figure 2: Tracking of some phenotypic traits of the arabidopsis plant used in our experiment.

cloud sequences by optimal transport for plant growth visualization. *Computer Graphics Forum*, 39, 05 2020. 5

Feature	Explanation
centre position	average location of the points in the branch
relative orientation	unit vector fixed by the farthest pair of points in the branch in the coordinate system
	of the main stem
number of segments	number of segments in the branch
semantic meaning	semantic meaning of the branch: main stem, base or other branch
point number	number of points in the branch point cloud

Table 1: Features extracted from the branch point cloud for machine learning.

Feature	Explanation
centre position	average position of the points in the segment
orientation	vector from one end of the skeleton to the other
degree	degree of the segment in the branch represented as a graph
diameter	length of the skeleton
geodesic distance to main stem	distance in the graph to the main stem
geodesic distance to base	distance in the graph to the base
point number	number of points in the segment point cloud
offset in branch	vector from the centre of the branch to the centre of the segment

Table 2: Features extracted from the segment point cloud for machine learning.



Figure 3: Registration results for 7 consecutive acquisitions of 3 arabidopsis plants, with different acquisition parameters.



Figure 4: Registration results for 7 consecutive acquisitions of 3 maize plants.



Figure 5: Registration results for 7 consecutive acquisitions of 3 tomato plants.



(b) Interpolation result from [1](image from their paper).

Figure 6: Comparison of interpolation results: (a) Our approach, (b) [1]. The plants shown with a gray background are actual acquisitions; the ones with a white background are interpolated.