2D/3D Optical/Range/Scene Flow, 2D/3D Tracking and Plant Growth from 3D Range Data

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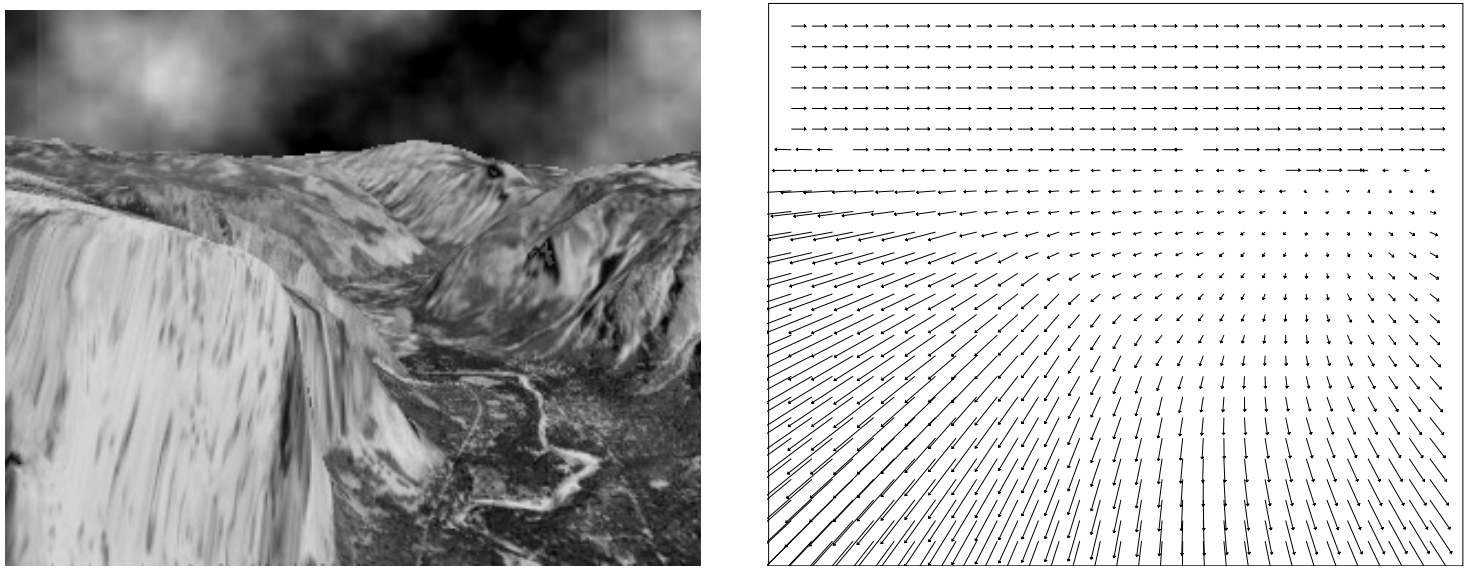
Activities/Courses

- On sattatical this year.
- Typically I teach CS2035b - Data Analysis and Visualization (MatLab) and CS9630a - Image Processing and Analysis plus another course, but not this year.

Computing Optical Flow



(a) (b)

(a) The middle frame from the **Yosemite Fly-Through** sequence and (b) its correct flow field.

Examples of Recent/Ongoing Research

- Computing 3D Optical Flow for gated MRI data of the left ventricle of a beating human heart using a model of the left ventricle [with Prof. Huang Fang, CSU]

- Scene flow (stereo depth maps plus left/right 2D optical flow) versus Range flow (3D depth maps and the X, Y and t derivatives) to compute 3D optical flow of surface points (with Seereen Noorwali)

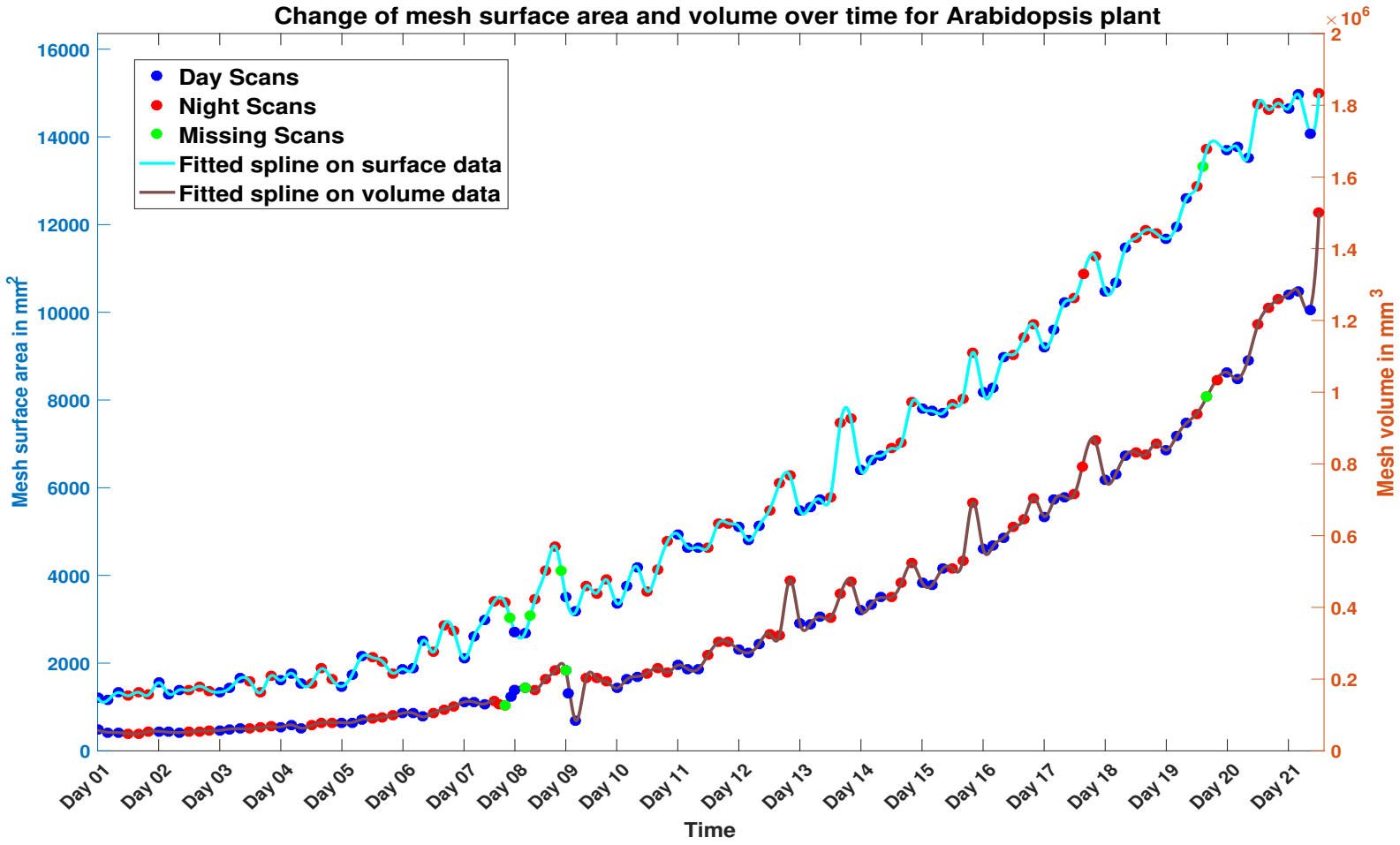
- Detecting Tornado "hook echos" in Doppler weather data, computing 3D wind velocity as 3D optical flow using dual Doppler radar and Wind-profiler data, computing long storm trajectories in Doppler weather data (with Bob Mercer, Hongkai Wang, Yong Zhang and many others).

- Quantitative plant growth

Reconstructed Arabidopsis plant point cloud (different colors indicate different scans). Note that there was no plant jittering in our setup as the wind could be fully controlled, unlike for the setup used in Brophy's work (described in Chapter 3).

Robot room where the experiment was performed

- Using 3D point clouds of multiple views of a growing plant (and the closed 3D triangular meshes computed from their registration) to non-invasively measure the 3D growth of the plant, using its 3D heighzt/area/volume measurements and the 3D areas of its canopy and individual leaves (with Chaudhury, Zhao, Pu, Akter).



Diurnal growth pattern of mesh surface area and volume for the Arabidopsis plant. The red dots represent night time scans, the blue dots represent day time scans and the four green dots represent missing scan data. A spline is fitted to both surface and volume scan data (shown in different colours). The y-axis in the left and right hand side represents the range of surface area and volume data respectively.

- Computing hierarchical 3D Scene/Range flow (3D Optical Flow on a 3D surface) with Seereen Noorwali.
- Computing 2D optical flow at occlusion using segmented closed occlusion regions
- Computing motion and structure from optical flow in a sequence of x-ray images of a bending knee event (with Yves Pritchard).

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