Oishi LAB.

[Spatiotemporal Modeling and Representation]

Advanced Mobility Research Center / Base Technologies for Future Robots

Spatiotemporal Media Engineering

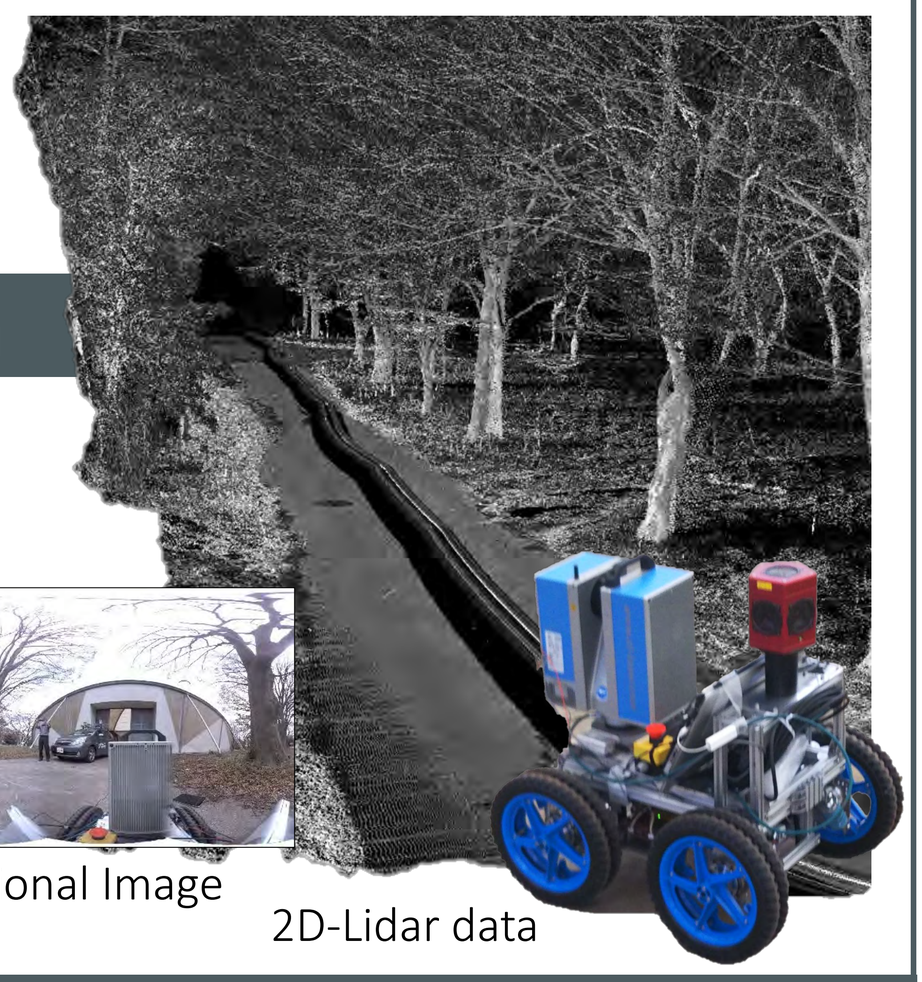
EEIS-Graduate School of Engineering

III-Graduate School of Interdisciplinary Information Studies

http://www.cvl.iis.u-tokyo.ac.jp

3D Vision and Analysis

We develop technologies aimed at autonomous robots and vehicles such as environmental modeling, recognition, and analysis using optical sensor devices such as LiDAR and omnidirectional camera.



3D measurement: optical sensor fusion

In the mobility system, it is essential to combine various sensors according to their measurement range, accuracy, and operating environment. We are developing a system that uses multiple sensors such as LiDAR and camera to generate an accurate 3D map of the environment. To realize this system, we are developing an accurate calibration method between multiple sensors, and position and pose estimation methods by fusing omnidirectional camera and laser profiler.

Omni-Directional Image

2D-Lidar data

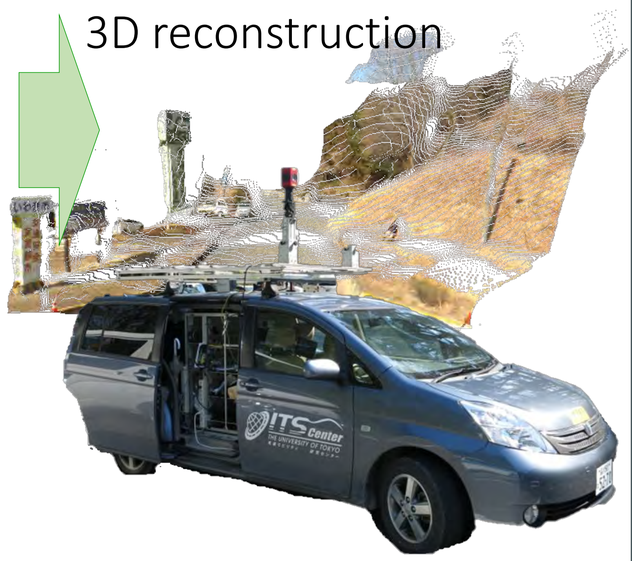
3D image processing: optical flow/depth estimation

The mobility system needs to recognize the surrounding environment dynamically during navigation. We are developing a method to acquire scene flow and 3D geometry simultaneously in real time. Since LiDAR has a trade-off between measurement time and density, a technique using a camera image is suitable for recognition in some cases. We propose a simultaneous optical flow/depth estimation method that uses two images from a continuous sequence and is robust to camera pose estimation error through relaxation of mutual 2D and 3D constraints.

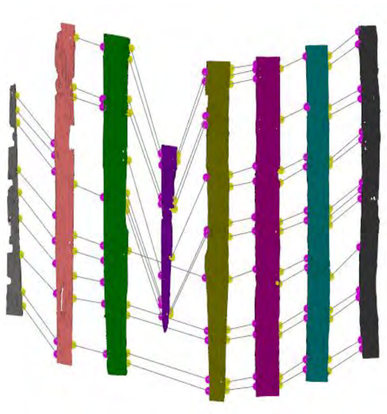
Input images

Camera poses

3D reconstruction



3D shape analysis: virtual reconstruction



Correspondences

Optimized

Virtual restoration

We can find new knowledge in various research fields by analyzing large amounts of three-dimensional data. The figure shows the virtual restoration of the second solar boat of King Khufu, which is estimated to be made approximately 4500 years ago and found near Great Pyramid of Giza. To reconstruct the entire shape of the boat by assembling the three-dimensional data of the excavated wooden parts, we are focusing on the development of physical deformation models and optimization algorithms.