

Sveriges lantbruksuniversitet Swedish University of Agricultural Sciences

Information about field tests with mobile laser scanning

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Joint work together with FOI and Skogforsk



Tested mobile laser scanning system

- ZEB1 with 3D SLAM
- Velodyne VLP 16 with stereo video cameras and 3D SLAM
- Leica Geosystems Pegasus Backpack with 3D SLAM

SLAM = Simultaneously Location And Mapping Pegasus system not presented in this seminar





































Laser scanner Velodyne VLP 16

- 300 000 measurements / second
- Scanning 360 degrees horizontal
- Scanning ± 15 degrees vertical
- Scanning of 16 planes simultaneously
- 10 revolutions / second



Visual SLAM using image matching of stereo video data, FOI





3D SLAM using laser data, one example

Aligning 3 D data, e.g., from time t₀ and t₁

How to find correspondence ?

- 1. Manual interpretation, automatic feature detection, or
- 2. Assume that closest points correspond and iterate (ICP)





Iterative closest point algorithm (ICP)

- 1. Find correspondence (pair-wise registration)
- 2. Find the function that minimize distance between points from each dataset
- 3. Calculate new point data (x, y, z) with the function (rotation, translation)
- 3. Repeat 1 3 until the error is low or maximum of iterations is reached

Converge if starting points are "close enough"



Point-to-plane instead of point-to-point ICP

Make it possible for flat regions to slide along each other





Iteration k = 1, Error = 0.47 m





Iteration k = 2, Error = 0.42 m









Iteration k = 4, Error = 0.15 m





Iteration k = 5, Error = 0.12 m





















Iteration k = 10, Error = 0.03 m









Iteration k = 12, Error = 0.016 m





Iteration k = 13, Error = 0.012 m





Iteration k = 14, Error = 0.009 m





Iteration k = 15, Error = 0.007 m

















Questions?

Presented work based on collaboration between Forest remote sensing section, SLU, Umeå (www.slu/srh) Electro-optical Systems, FOI Skogforsk Uppsala