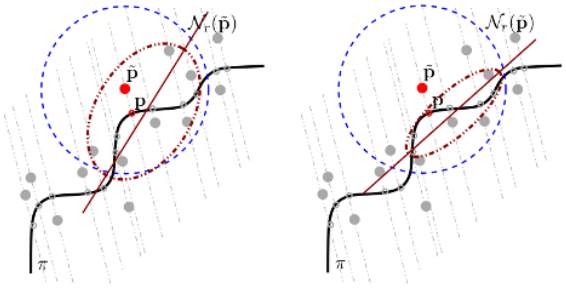
ViRVIG
Visualització, Realitat Virtual i Interacció Gràfica

www.virvig.eu
C. Llorens i Artigas 4-6
Edifici U, 1er pis
E- 08028- Barcelona

Sensor-aware Normal Estimation for Point Clouds from 3D Range Scans

Comino, Marc; Andujar, Carlos; Chica, Antoni; Brunet, Pere



Normal vectors are essential for many point cloud operations, including segmentation, reconstruction and rendering. The robust estimation of normal vectors from 3D range scans is a challenging task due to undersampling and noise, specially when combining points sampled from multiple sensor locations. Our error model assumes a Gaussian distribution of the range error with spatially-varying variances that depend on sensor distance and reflected intensity, mimicking the features of Lidar equipment. In this paper we study the impact of measurement errors on the covariance matrices of point neighborhoods. We show that covariance matrices of the true surface points can be estimated from those of the acquired points plus sensordependent directional terms. We derive a lower bound on the neighbourhood size to guarantee that estimated matrix coefficients will be within a predefined error with a prescribed probability. This bound is key for achieving an optimal trade-off between smoothness and fine detail preservation. We also propose and compare different strategies for handling neighborhoods with samples coming from multiple materials and sensors. We show analytically that our method provides better normal estimates than competing approaches in noise conditions similar to those found in Lidar equipment.

http://dx.doi.org/10.1111/cgf.13505

UPC