

ICPSAC: A New Robust and Accurate Registration Algorithm

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Abstract

The measured data acquired by sampling the same scene at different time instants and from different perspectives, is expressed in different coordinate frames. Registration is the process of coherently expressing the different sets of data into one coordinate system. With this thesis, a strategy for building reconstruction relying on LIDAR data only is presented. It provides a comprehensive introduction into the field of reconstruction from LIDAR data, for both indoor and outdoor mapping. Our algorithm must face a problem which has not been satisfactorily solved yet: finding an accurate transformation between two point sets (measurements obtained at different time instants) against quite large rotation and translation, noise and strong outliers presence. We describe and compare various already existing techniques and propose a largely improved algorithm based on Point Set Registration by using a RANSAC-based ICP (ICPSAC) approach that makes it a robust and accurate point set registration algorithm in presence of noise and large amount of outliers. We will show how the algorithm is stable even in difficult work conditions. In fact it can properly deal with occlusions (i.e., objects that partially appear in one measurement) and it has been successfully tried with low-overlapping scenes. Simulated and experimental results show that our algorithm achieves very good performance in terms of both robustness and accuracy in a relatively short time.