Fast Registration of 3D Laser Scans without Initial Guess

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Abstract

State of the art graph-based 3D SLAM systems are typically divided into the so-called front- and backend. The frontend's task is to align laser scans locally, constructing a graph of the measurements in the process. The backend's task is to optimize this graph in order to find a maximally consistent configuration of the nodes. The well-known ICP algorithm is often used to align pairs of laser scans. As it only provides local convergence, it generally requires an approximate guess in order to determine the correct relative transformation. In practice, this guess is often obtained from a robot's odometry. However, in some applications this odometry information in not available and a fast initial guess is needed for real-time operation. Existing feature-based approaches are often unsuitable for real-time operation due to their computational requirements. We present a featureless algorithm that is able to compute an approximate transformation between two laser scans quickly, serving as initial guess for ICP. Our algorithm is an adaption of a 2D correlative scan matching algorithm by Olson to 3D and will be evaluated in the context of 3D SLAM. We compare to results that use features as they are used in image processing to match images.

We make some plausible and weak assumptions on the scan acquisition and experimentally show that these are usually met. Our experiments show that the presented algorithm is able to align two 3D laser scans quickly and reliably in the context of mobile robotics and stand-alone laser scanning.

Short Biography

Dietrich Paulus obtained a Bachelor degree in Computer Science from University of Western Ontario, London, Ontario, Canada, followed by a diploma (Dipl.-Inf.) in Computer Science and a PhD (Dr.-Ing.) from Friedrich-Alexander University Erlangen-Nuremberg, Germany.

Since 2001 he is at the institute for computational visualistics at the University Koblenz-Landau, Germany where he became a full professor in 2002.

His primary research interest are active computer vision, object recognition, color image processing, medical image processing, vision-based autonomous systems, and software engineering for computer vision. He is member of Gesellschaft für Informatik (GI) and IEEE.

THE FULL TEXT OF THIS CONTRIBUTION WILL APPEAR IN THE Journal JIST in 2015