Omnidirectional visual SLAM under severe occlusions

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Abstract SLAM (Simultaneous Localization and Mapping) under severe occlusions in crowded environments poses challenges both from the standpoint of the sensor and the SLAM algorithm. In several approaches, the sensor is a camera pointing to the ceiling to detect the lights. Nevertheless, in these conditions the density of landmarks is usually low, and the use of omnidirectional cameras plays an important role due to its wide field of view. On the other hand, the SLAM algorithm has to be also more involved as data association becomes harder in these environments and, also, due to the combination of omnidirectional vision and the characteristics of the landmarks (ceiling lights): conventional feature descriptors are not appropriate, the sensor is bearing-only, measurements are noisier, and severe occlusions are frequent. In this paper we propose a SLAM algorithm (OV-FastSLAM) for omnivision cameras operating under severe occlusions. The algorithm uses a new hierarchical data association method that keeps multiple associations per particle. We have tested OV-FastSLAM in two real indoor environments and with different degrees of occlusion. Also, we have compared the performance of the algorithm with several methods for the data association. Non-parametric statistical tests highlight that OV-FastSLAM has a statistically significant difference, showing a better performance under different occlusion conditions.

Palabras chave Hierarchical data association, Severe occlusions, Omnidirectional cameras, Bearing-only visual SLAM

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