Combination of block-based image matching using local binary patterns and LIDAR data for vehicle localization

This paper presents a method based on image and LIDAR data for vehicle localization. The method supposes the availability of a database composed with geo-referenced images and LIDAR data of the travelling environment. Given an image, the method starts by searching the similar image in the geo-referenced database using a block-based image matching. To perform that the grayscale image and the disparity map are first divided into equally overlapped blocks size. For each block a LBP (Local Binary Pattern) descriptor is calculated. Then, each image is characterized by a global descriptor obtained by concatenating the local descriptors associated with the blocks. Using block-based descriptors is able to reduce the ambiguity of image matching. Finally, the image is compared and matched to the reference images using the partial least squares regression (PLSR) recognition model built on the global descriptors. The potential images of the reference database that are considered for comparison and matching with the given image are determined using the last estimated position. The matching procedure may lead to false positive recognition, and thus to a wrong estimated position. To overcome this situation, false positives can be detected and rejected using LIDAR data. This is first performed by associating LIDAR data corresponding to the matched images (current image and reference one) thanks to ICP algorithm (Iterative Closest Point). This association procedure allows estimating the transformation (translation) between these LIDAR data. False positive is then detected and rejected by checking the coherence between the matched images (current image and reference one) using a threshold based test on the estimated translation. If a false positive is detected, the current position is estimated from the last one and consecutive LIDAR data using ICP (between current instant and last one). In case of a true positive match, the current position is estimated from the LIDAR data corresponding to the matched images using ICP algorithm. Indeed, the estimated transformation is used to determine the current position from the position associated to the reference image. This method allows reducing drifting that can occur if LIDAR data are used alone for the whole sequence. The proposed method is tested and evaluated using real datasets acquired in urban environments, and the obtained results show its effectiveness.