

Title	特徴点マッチングにおけるモーション推定を改善するためのプレフィルタリング手法
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特徴点マッチングにおけるモーション推定を改善するための プレフィルタリング手法

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Most of the tasks accomplished by camera-equipped robot/mobile platforms are complicated and sophisticated (such as mapping, localization, navigation, and similar others). Most of these visual tasks are based on obtaining the motion of the camera/mobile platform. In absence of any additional data apart from the visual data, motion estimation is done by using image matching (or image registration) methods. This method usually has been done through feature detection, description, and matching to establish correspondences between the images. But this procedure generates some mismatched points (e.g., due to noise), which are called outliers. There are some robust estimation methods (e.g., Random sample consensus (RANSAC)) to eliminate the outliers and estimate motion. The robust estimation methods occupy a large amount of computational cost whole image-matching pipeline due to their iterative procedure based on random sampling.

RANSAC is based on random sampling and threshold selection and it is one of the most widely known robust estimation methods in the image-matching framework since its easiness of implementation and high performance. But the computational cost of the method is high when the outlier ratio is high. Therefore, there have been proposed several methods to improve the RANSAC. Although they have improved their overall performance, their computational cost can still be high when the outlier ratio is large. In addition, there have been proposed several methods using geometric relationship filtering nowadays. For example, GR-RANSAC successfully removes outliers from the matched points under the assumption that the distances and angles between 2D features are similar for contiguously acquired images with small disparity, such as video images, leading to a reduction in the number of iterations. However, as noted by the authors, it is necessary to redetermine the angle and distance thresholds when using different datasets than the one used in the paper. Moreover, the authors also proposed GNN-RANSAC, which is a combination of GR-RANSAC and GNN. These methods are successfully reducing the number of iterations without modifying RANSAC. Therefore these methods are useful for other robust estimation methods in the image-matching framework.

We propose a novel pre-filtering step for eliminating the outliers obtained by established correspondences and reducing the number of iterations needed in the robust estimation method. Our pre-filtering step is motivated by the general procedure of visualizing the established matches among images. We

tile images together and search for parallel lines connecting correspondences to eliminate the outliers.

In this research, we evaluate our pre-filtering step in extensive computational and comparative experiments using both simulated data involving along with real images and using a real dataset. Moreover, the GR_RANSAC algorithm is added as a comparison baseline since it has a similar position in the image-matching pipeline to our proposed method. Our proposed method improves the motion estimation accuracy and the total number of iterations compared with conventional RANSAC. Moreover, GR_RANSAC's total number of iterations lower than our proposed method but GR_RANSAC is mostly failed to estimate homography in our experiment. Therefore our pre-filtering step is considered more efficient and flexible compared with conventional RANSAC and GR_RANSAC.