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Robot Visual Localization Through Local Feature Fusion: An Evaluation of Multiple Classifiers Combination Approaches

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Abstract In the last decade, local image features have been widely used in robot visual localization. In order to assess image similarity, a strategy exploiting these features compares raw descriptors extracted from the current image with those in the models of places. This paper addresses the ensuing step in this process, where a combining function must be used to aggregate results and assign each place a score. Casting the problem in the multiple classifier systems framework, in this paper we compare several candidate combiners with respect to their performance in the visual localization task. For this evaluation, we selected the most popular methods in the class of non-trained combiners, namely the sum rule and product rule. A deeper insight into the potential of these combiners is provided through a discriminativity analysis involving the algebraic rules and two extensions of these methods: the threshold, as well as the weighted modifications. In addition, a voting method, previously used in robot visual localization, is assessed. Furthermore, we address the process of constructing a model of the environment by describing how the model granularity impacts upon performance. All combiners are tested on a visual localization task, carried out on a public dataset. It is experimentally demonstrated that the sum rule extensions globally achieve the best performance, confirming the general agreement on the robustness of this rule in other classification problems. The voting method, whilst competitive with the product rule in its standard form, is shown to be outperformed by its modified versions.

Keywords Robot visual localization · Local image features · Information fusion · Multiple classifier systems · Discriminativity