Joint Geometric Verification and Ranking using Multi-View Vocabulary Trees for Mobile 3D Visual Search

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Current mobile visual search solutions achieve search results based on the appearance of objects in images captured by mobile devices. These solutions fail if different real objects appear similar in the captured images. To solve this problem, mobile 3D visual search captures not only the visual appearance of query objects, but uses also the underlying 3D geometry [1] [2]. To obtain the 3D geometric information of the object, we use the method in [2] to generate hierarchically structured multi-view features from the multi-view images. With hierarchically structured multi-view features, we are able to generate vocabulary trees which are based on multi-view feature descriptors. Both hierarchical and tree structures provide us an advantage when constructing a memory-efficient representation. We use the concept of *term frequency-inverse document frequency (tf-idf)* to assign the weighting to each leaf node. Different from conventional tf-idf weighting, which is based on images, our weighting is based on the database objects associated with the multi-view images. As the 3D geometry information is incorporated in the multi-view vocabulary tree, it allows us to design an algorithm for fast 3D geometric verification at low computational complexity.

For fast and accurate ranking, we develop an iterative algorithm for joint geometric verification and tree matching. We consider a constrained problem. If candidate objects have very similar tf-idf scores, then the ranking of these candidate objects is determined by geometric verification. We solve the problem by sorting according to the geometric consistency. With our algorithm, we are able to re-rank groups of objects when they satisfy the constraint of similar score level. Due to the vocabulary tree, we can update the scores easily. This approach allows joint 3D geometric verification and ranking. The top-ranked object is on the highest score level and has the best 3D geometric consistency.

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References:

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