

Aggregation Techniques of Binary Local Image Descriptors

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Abstract

The article presents a set of new approaches for aggregation of binary local image descriptors. The local image descriptors are proven to be relatively fast, effective and very flexible techniques in wide range of image retrieval tasks. There are a number of binary descriptors which are characterized by the fact that the output data is in the form of a binary string like Binary Robust Invariant Scalable Keypoints (BRISK), Oriented BRISK, Fast Retina Keypoint (FREAK), etc., which are a good alternative for for example the most popular Scale Invariant Feature Transform (SIFT). The proposed set of aggregation algorithms is composed of two techniques based on the direct ordered comparisons of the binary elements in the descriptor bitstreams and third, the most complicated, based on Restricted Boltzmann Machines (RBM). Since the first two are intended for systems with limited memory and optimized for fast calculations, the third is a variation of general Boltzmann machines with restriction that its neurons form a bi-directional graph and can be understood as a stochastic neural network which can learn a probability distribution based on the input data. The all three are intended to store the compact representation of the set of local binary image descriptors extracted from the given image or a video frame, thus representing its semantic content. It is one of the last crucial image description steps next to the well known Bags of Visual Words, Locally Sensitive Hashing, Random Forests or Vector of Locally Aggregated Descriptors. This is the step which is featured of long training process where usually large amount of memory is needed. In our work we have proven that with the aggregation techniques proposed in this paper this process can be significantly reduced without any or with very limited loss of the final description accuracy.

References

1. K. MIKOLAJCZYK AND C. SCHMID. A Performance Evaluation of Local Descriptors. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 27, No. 10, October 2005.
2. A. FISCHER AND C. IGEL. An Introduction to Restricted Boltzmann Machines. In: L. Alvarez, M. Mejjail, L. Gomez, J. Jacobo (Eds.), *Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications*, Vol. 7441 of *Lecture Notes in Computer Science*, Springer Berlin Heidelberg, 2012, pp. 14-36.