COMPRESSED HISTOGRAM OF GRADIENTS: A LOW BITRATE DESCRIPTOR

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Motivation

Transmission and storage of feature descriptors are of critical importance in the context of mobile distributed camera networks and large indexing problems. We propose a framework for computing low bit-rate feature descriptors with a 16x reduction in bit rate. The framework is low complexity and has significant speed-up in the matching stage. Our proposed CHoG descriptor outperforms all existing schemes.

Prior Work

PCA-SIFT
[Ke and Sukanthkar, 2002]

Linear discriminant analysis
[Hua et al., 2002]

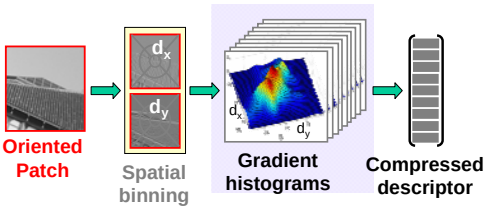
Transform coding of SURF and SIFT
[Chandrasekhar et al., 2009]

Random projections of SIFT
[Yeo et al., 2008]

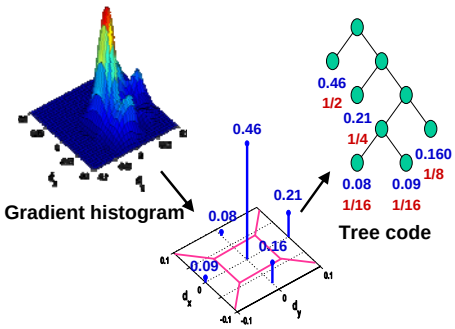
Similarity Sensitive Coding of SIFT
[Shakhnarovich, 2005] [Torralba, 2008]

Patch Compression
[Makar, 2009]

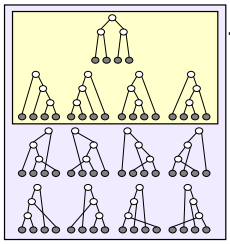
CHoG Pipeline



Histogram Quantization



Huffman Tree Index Coding

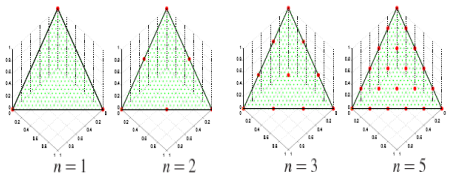


Trees with *n* leaf nodes

$$C_{n-1} = \frac{1}{n}\binom{2n-2}{n-1}$$

n	3	4	5	6	7
C_{n-1}	2	5	14	42	132
Unique Perms.	**3**	**13**	**75**	**525**	**4347**

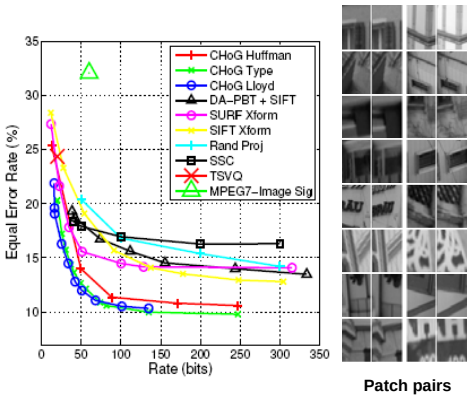
Type Coding



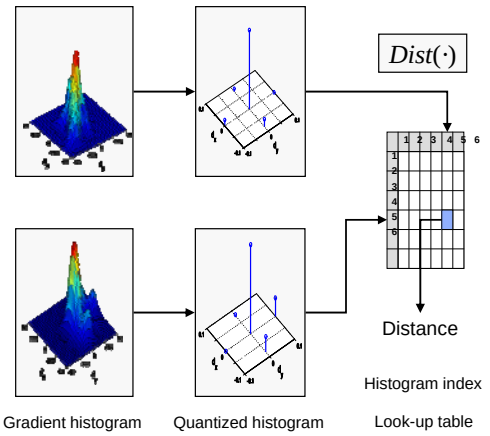
$$q_i = \frac{k_i}{n},\ k_i, n \in \mathbb{Z}_+,\ \sum_i k_i = n$$

Number of types $\left(\!\binom{m}{n}\!\right) = \binom{n+m-1}{m-1}$

Feature Matching



Compressed Domain



Timing Analysis