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Dimensionality Reduction of Features using Multi Resolution Representation of Decomposed Images

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Problem

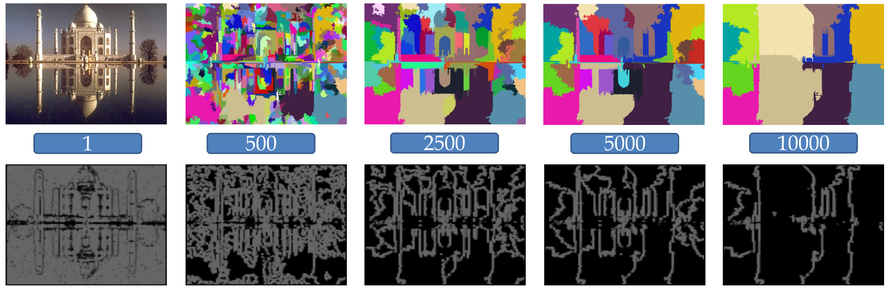
The quest of dimensionality reduction arises in domains that operate on high dimensional, input data. Feature selection methods, applied post a descriptor function, proven effective to alleviate redundant dimensionality of a descriptor representation, but are less predictive:

PCA-SIFT	PCA-HOG	LPP-HOG	PLS-HOG

Contribution

Intuitive multi resolution, image decomposition representation (MID) that cooperates with a successive descriptor operator (HOG), to improve dimensionality reduction. We demonstrate high matching rates for multi class classification scenarios, at a comparable or more concise vector dimensionality, reported on feature selection methods.

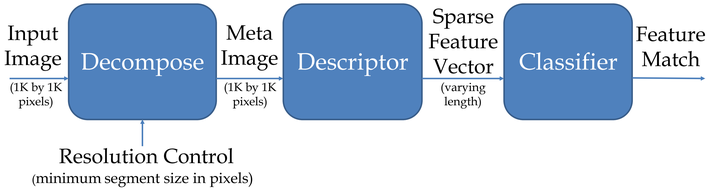
HOG-MID



Black pixels, indicative of feature vector sparsity, lead to a more compact representation

Method

First, we decompose the input image into a set of clusters of similar points, in feature space, using a graph based, segmentation algorithm. The flat appearance of the decomposed image, lets the successive HOG descriptor, resorts to exclusively encode segment edges. Thus promising, through the MID maps, a sustainable size reduced, sparse feature vector.



Setup

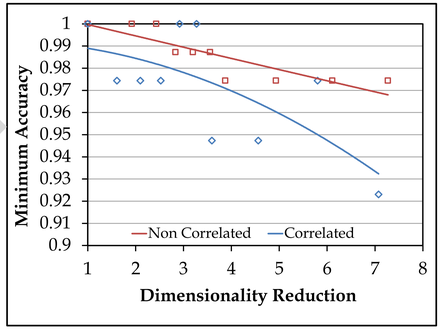
For training, we use both non and correlated image sets. Each set is seeded with four base classes, of one image each. We apply artificial warping, to augment our training collection by a factor of 100:

Base Classes	Class Images	Set Images	Set MID Maps
4	100	400	3600

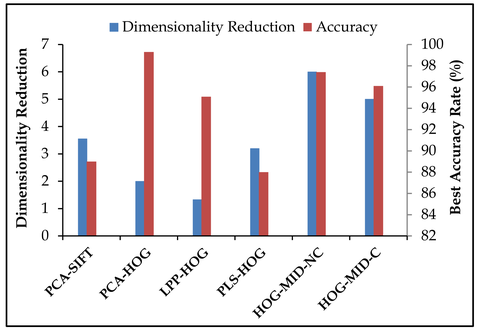
Non-Correlated Set

Correlated Set

Results



HOG-MID Accuracy Relative to Native HOG



System Level, Comparative Performance

Conclusions

- The embodiment of MID is computationally efficient, and more compact than both native HOG and state-of-the-art, compound local descriptors.
- Shown robust discrimination performance for the more challenging, correlated set of same person, face images.
- Continue research of BOVW representation, to possibly replace HOG.

References

Felzenszwalb, P. F. and Huttenlocher, D. P. (2004). Efficient Graph-Based Image Segmentation. *International Journal of Computer Vision*, 59(2): 167–181.

Dalal, N. and Triggs, B. (2005). Histograms of Oriented Gradients for Human Detection. *Computer Vision and Pattern Recognition (CVPR)*, pages 886–893.