Content-based Image Retrieval by Combining Growing Hierarchical Self Organizing Map Classifiers for Color, Shape and Texture Features

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Introduction

➢ This paper presents the development of a content-based image retrieval system that combines a set of GHSOM (Growing Hierarchical Self Organizing Map) [1] classifiers taking as input color, shape and texture features. Experiments demonstrated combination scenarios that produced better accuracy in image classification. Automated search in large image databases is still an open research problem [2]. Most applications found in the literature still present low precision and recall

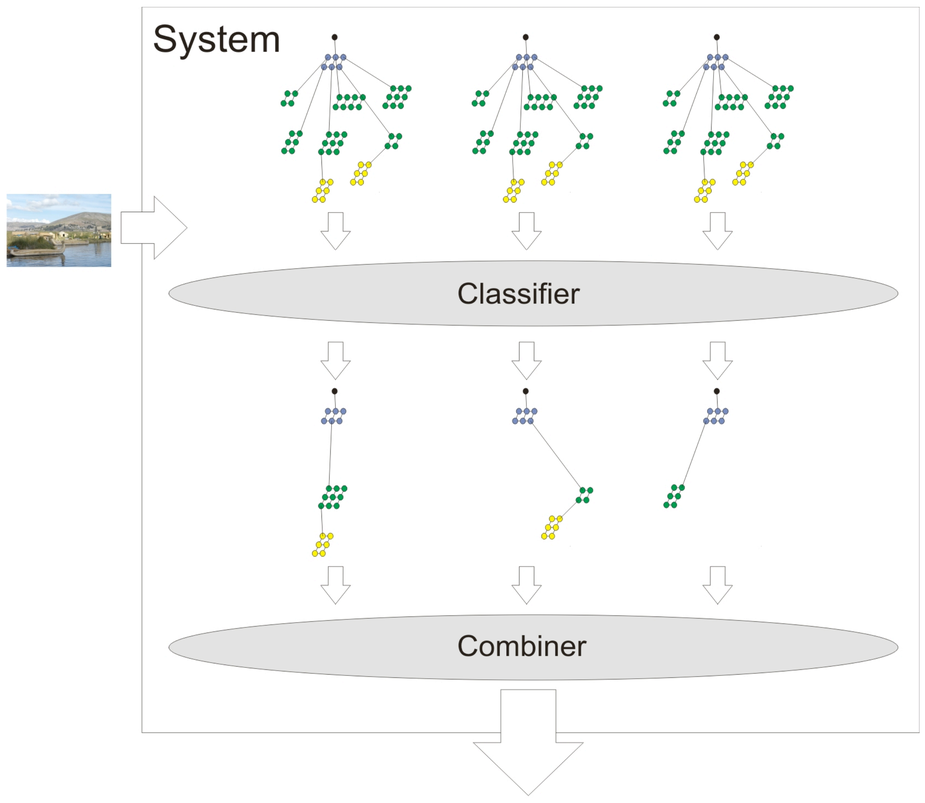
Content-based Image Retrieval

➢This research considered the most common features, which are color, shape and texture.

➢ A typical CBIR system contains three modules: Feature Extraction; Indexing; and Retrieval.

➢The classification method adopted in this work was based on GHSOMs, a data structure similar to a B-Tree.

Proposed Approach



Proposed Combination architecture

➢Classifier combination is a set of techniques that is proving useful in many application scenarios. Its main advantage is for classifiers are able to overcome deficiencies of one another.

➢The classifier combination method adopted in this work is based on a voting process.

$$v_i = \sum_{g}^{G} (1 - QE_{g,i}) \cdot \left(\frac{LC_{g,i}}{LT_g}\right)$$

➢For every image returned by each selected classifier there will be a value associated to it, this value will be used to sort the final result.

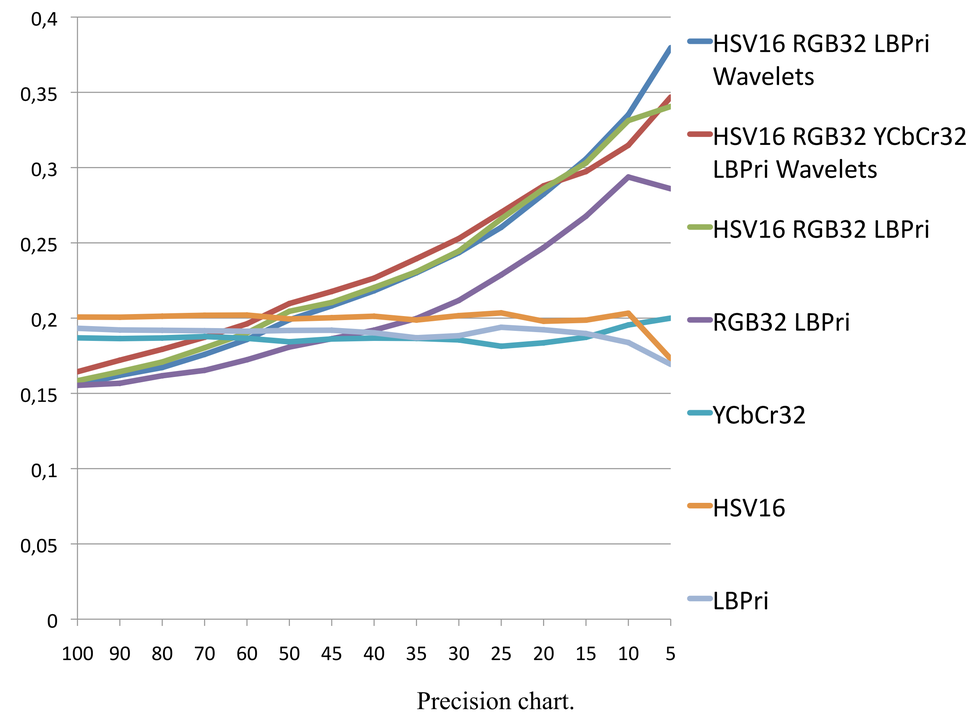
➢To evaluate the experimental results of the content based image retrieval systems the precision and recall measures are commonly used.

Experimental Results

➢ Microsoft's Research Cambridge Object Recognition Image database, a image base with 800 images in 16 sets of 50 images each was used on our experiment.

➢ Six GHSOM networks that were chosen to evaluate classifier combination were the ones which presented the best individual results.

➢ A result filtering strategy has been adopted, which consisted of gradually varying the number of images recovered using the classifier combination and recalculating the precision for each number of returned images tested.



Precision chart.

➢In comparison to the simple classification methods, classifier combination resulted on a considerable improvement for precision.

➢Initially the simple classification has a better precision, when considering more than 70 images, but with a reduction on the resulting images, there is a natural reduction in the images that are not considered to be similar and the combination results are greatly superior to the ones of the simple classification.

➢Even with the simpler combinations, the results are superior when the amount of returned images is under 40. Not even the best individual result is superior to the worst combined result.

References

[1] A. Rauber, D. Merkl, and M. Dittenbach. The growing hierarchical self-organizing map: exploratory analysis of high dimensional data. Neural Networks, IEEE Transactions on, 13(6):1331–1341, 2002.
[2] R. Torres. Recuperação de imagens por contedo. Revista Computação Brasil - Sociedade Brasileira de Computação, 2006.