Combining Tree and Feature Classification in Fractal Encoding of Images

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One of the main problems with fractal compression of images is the long encoding time, due to the repeated search of the domain block pool. Faster search can be achieved through block classification. This is done by grouping the domain blocks independently and online into predefined classes. Only the class of a range block is then searched for a matching domain. In [1], we presented another method for speeding up the search. It is based on an incremental evaluation of the distance between two blocks. We structure the domain pool into a tree. For a given range, we home onto a list of matching domains through a pruning algorithm based on the evaluation procedure. In this work we combine the tree method with the block classification to get an even faster search. In block classification the classes are stored without any additional structure, usually as lists, and searched linearly until a best match is found. We should expect an enhancement if we arrange the classes into trees, and use the tree algorithm for the search. Another way to view this is to regard the domain pool grown into lots of small trees rather than one big one. A significant speed-up is achievable provided, firstly that only reasonable size classes are grown into trees, and secondly that the feature extraction methods for the classification and for the tree construction should be independent. We used the Jacobs, Fisher and Boss method for classification, which depends on block quadrant averages as explained in Fisher's book [2]. The book includes also an implementation. We modified the code to include the tree search method. The evaluation algorithm is unaffected by unitary transforms, as it is based on Euclidean distance. To use an independent method, we compute the direct cosine transform of the blocks in each class and use the low frequency coefficients to construct the tree. The experiments show a speed-up of around 75% over the the purely classification based method, with a drop in PSNR of about 1dB. The visual quality of the decoded images are very similar.

References

[1] B. Bani-Eqbal, 'Enhancing the Speed of Fractal Image Compression', *Optical Engineering, Vol 34, No 6, pp 1705-1710, June 1995.*

[2] Y. Fisher, Editor, *Fractal Image Compression: Theory and Applications to Digital Images*, Springer Verlag, 1994.

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