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A methodology for a universal contour-texture coding [1]

Source : UCL, Belgium

Introduction

The contour-texture coding principle has been proposed by the EPFL [1] as a second-generation coding method, allowing very high compression ratios.

In this report, some improvements to this method are proposed :

- we propose a new segmentation methodology;
- we propose a new texture coding;
- we propose to combine a classical DCT coding with the contour-texture method in order to encode efficiently the zones where the signal can not be considered as a texture.

The method and the results obtained have still to be optimized. Nevertheless our methodology has the main advantages to have *reasonable implementation costs* and to be *universal*, i.e. it can be applied to every picture, whatever its information contents is.

1 Segmentation

Our segmentation must be adequate for the texture coding technique that we have choosen. As we use a spectral description of the texture for their encoding, our segmentation is based on local oriented Gabor filters: 4 Gaussian filters at 0, 45, 90 and 135 degrees. The variance of the filters is quite large in the frequencies domain: this allows to obtain a precise location of the contours in the pel domain. In order to avoid an overlapping of the filters, their central frequency is choosen quite high.

The output of the filters is used in order to determine 2 types of regions :

[1]Laboratoire de Télécommunications, Université Catholique de Louvain, Place du Levant, 3, B-1348 Louvain-la-Neuve, Belgium, Tel. +32-10-472300.

- textured (or flat) regions, where the signal is band-limited (with most of the energy at the output of one filter);
- active regions, where the signal is not band-limited.

The relevance of the regions is increased by a split-and-merge algorithm developped at the Aachen Technical University [2].

It is to notice that some authors have also proposed to use local oriented filters for the segmentation [3], [4]. Our technique is inspired by their methodology.

2 Texture coding

Two methods for the texture encoding are described in the litterature:

- the selective deconvolution [5];
- the orthogonalization of the basis functions [6];

These two methods are iterative methods which are very expensive, in computation time, for big regions. We have considered a cheaper method.

Our method uses a technique developped for the speech processing [7] : it is the harmonic extrapolation. The texture is extrapolated in the smallest rectangular area in which the contour is included. The extrapolated signal is thereafter DCT coded if the maximumoutput of the filters is in the vertical or horizontal directions. It is DFT encoded otherwise.

3 Active regions coding

Our texture coding is valid only if the texture is band limited. In the active regions, we have choosen to encode the signal by a simple 4×4 DCT (small blocks are enough for low-correlated regions). The 4×4 blocks truncated by the contours are mapped to 1-D vectors to which a 1-D DCT of adequate order is applied.

4 Results

We have simulated the algorithm on a textured image (DICK) and on a very active picture (KIEL). We have considered the following parameters :

- the contours are encoded with 1.2 bit/pel [8];
- the textured and active regions are encoded by only one VLC;
- we have produced, for comparing the results 8×8 DCT pictures coded at the same output of the VLC (one VLC for all the transform coefficients).

Simulations will be shown at the meeting.

5 Conclusions

The UCL approach to object-based coding has the following aims:

- to have reasonable computation costs;
- to be universal.

The computational costs have imposed to consider a new method for texture coding. Efficient texture coding requires a specific segmentation. The very active regions are encoded by a classical DCT scheme. This is our main conclusion : in our opinion, the future coding techniques will be based on a cocktail of methods, each one being adapted to a kind of region of the picture.

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