Erratum: "A Review of the Fractal Image Compression Literature"

Due to typesetting errors in the article, "A Review of the fractal Image Compression Literature" by Dietmar Saupe and Raouf Hamzaoui, which appeared in the November 1994 issue of "Computer Graphics" (volume 28, number 4), we are reprinting the affected sections. Our sincerest apologies to the authors and to our readers for the puzzlement and inconvenience this error must have caused.

The following sections and figure should replace those printed in the original.

Collage Theorem

Let T be a contraction on the complete metric space (E,d) with contractivity factor s and fixed point g. Let $f \in E$.

Then $d(f,g) \leq \frac{1}{1-s} d(f,Tf)$.*

* *The contraction factor $s<1$ of T satisfies the estimate $d(Tf_1,Tf_2) \leq s, d(f_1,f_2)$ for all images f_1, f_2*

Thus, by minimizing the distance between f and Tf (the collage of the image), we hope to minimize the distance between the fixed point g and the given image f. Of course, if the value of s is close to 1, nothing ensures that this method provides a good approximation. Yet this was the original idea of Barnsley and most of the fractal based algorithms rely on the same approach. The fractal compression scheme can be viewed as two consecutive steps.

1. The encoding process (see Figure 1):

It consists of the construction of the operator T which will be defined by a set:

$$\{(R_k, D_k, u_k, v_k), 1 \leq k \leq N\}$$

The sets R_k, called ranges, form a partitioning of X. The sets D_k called domains, are also subsets of X but may overlap. For each R_k, a D_k, a bijection $u_k : D_k \to R_k$ and a contraction $v_k : G \to G$ (this map adjusts the intensity values in the domain to those in the range) are chosen such that the distance $d(f_{/R_k}, v_k f_{/u_k^{-1}R_k})$ is as small as possible. This is simply realizing the condition $f \approx Tf$ locally by exploiting the redundancy contained in the image since we seek for each part of the image corresponding to a range a similar (under appropriate contractive transformations) part corresponding to a domain. Finally, the operator T is given by $Tf = \sum_{k=1}^{N} T_k f$

where $T_k f(x) = 1_{E_k}(x) v_k(f(t(x)))$

and $t(x) = \sum_{k=1}^{N} 1_{R_k}(x) u_k^{-1}(x)$.

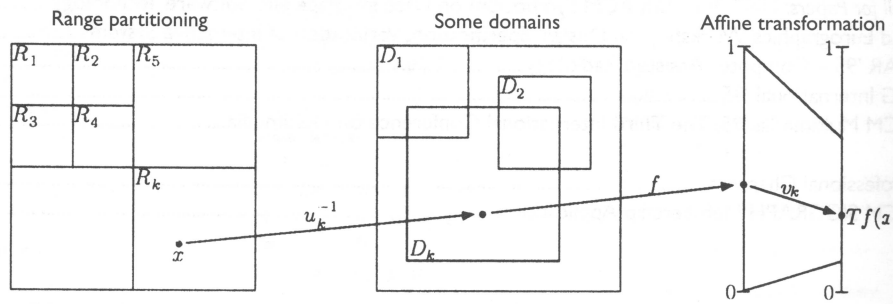

Figure 1: *Elements of the fractal code.* ***Left:*** *Partitioning of the image region (a square) into ranges.* ***Center:*** *some of the corresponding domains.* ***Right:*** *the affine transformation v_k for the k-th domain-range pair. For each domain-range pair (D_k, R_k) there is an (invertible) geometric transformation $u_k : D_k \to R_k$. The function f evaluates image intensities. For a point $x \in R_k$ we compute its preimage $u_k^{-1}(x)$ in the corresponding domain D_k, look up the image intensity, $f(u_k^{-1}(x))$, and finally apply the affine transformation, v_k, obtaining $Tf(x) = v_k f u_k^{-1}(x)$ for $x \in R_k$.*