Vision Flash 6

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How to Use .VSCAN

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I. A COOKBOOK APPROACH

The call to .VSCAN looks like this:

.VSCAN PTABLE,

where the parameters governing the scan, pointed to by the tag PTABLE, are 11 in number:

```
PTABLE:  WBIT,,VCONO
         -LENGTH,,ARRAY
         XRES,,YRES
         R1
         R2
         C1
         R3
         R4
         C2
         P1
         P2
```

and the intensities end up stored in locations ARRAY ... ARRAY + XRES*YRES - 1.

Scanning within some arbitrary quadrilateral on the vidi field, e.g.:

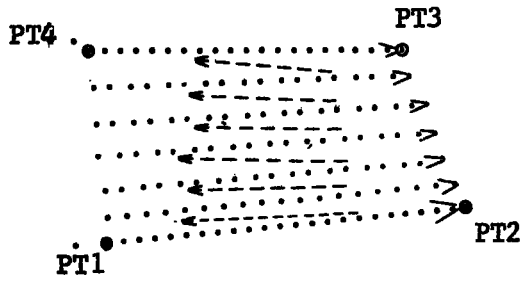

Figure 1.

is under control of these parameters, generated as follows:

Parameter 1 is described in the ITS manual; if in doubt, use 0,,3.

Parameter 2 consists of the negative of the total number of points to be examined in the left half; and the starting address of the block into which the intensities are to be stored in the right half.

Parameter 3 has the number of points in each scan in the left half; and the number of scans in the right half.

Parameters 4-11 are described in the ITS manual; however it is not obvious how one goes from the corner points of a desired scan to the parameter values. The function EIGHTVPARAM (in appendix) given the appropriate parameters, in order R1, ... P2, given the corner points PT1, PT2, PT3 and PT4 (in the form (x y)). The relation between the resulting scanning pattern and the corner points is as shown in figure 1: If the point PT2 is directly above PT1, then the scans will be made vertically; if the point PT2 is to the right of PT1, the scans will be horizontal; if PT4 and PT3 are below PT1 and PT2, then each successive scan will be below the previous one; etc. The coordinate system of these pointe assumes that the vidi field goes from (0 0) to (1024. 1024.).

II. HORIZONTAL AND VERTICAL SCANNING WITH SOME KNOWLEDGE OF WHAT IS GOING ON

The parameters R1, ... P2 are fixed point quantities with the binary point in the middle of the word. Thus if they have integer values, these integers should be stored in the left half. The origin of the scan is always (C1,C2). Several simple cases:

1) For a horizontal scan of length L, let R1=L and R2=R3=R4=P1=P2=0.

2) For a vertical scan of length L, let R3=L, and R1=R2=R4=P1=P2=0.

3) For a vertically ascending sequence (of height H) of left-right horizontal scans of length L, (See figure 2)

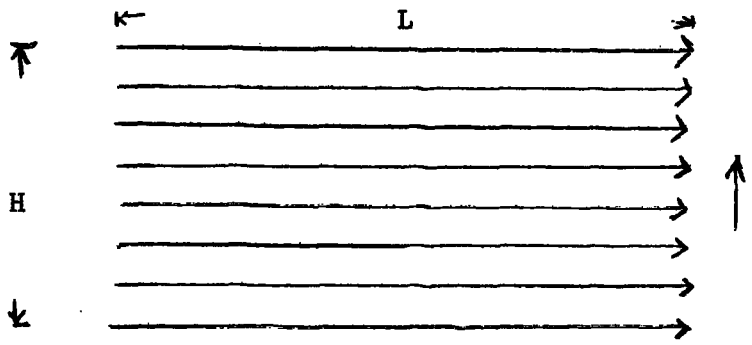

figure 2.

let R1=L R4=H and R2=R3=P1=P2=0.

4) For a sequence of ascending vertical scans of length L, with each successive scan to the right of the previous one (see figure 3) use R2=W, R3=L and

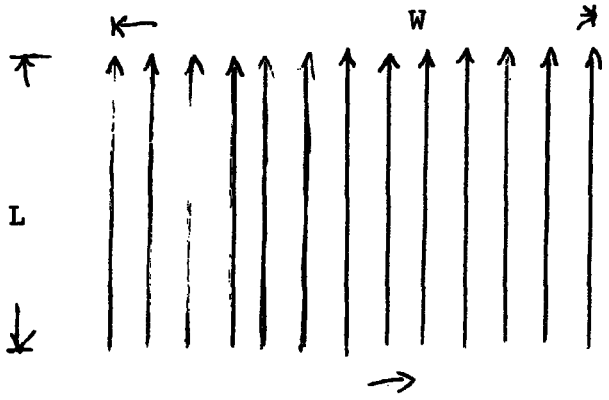

figure 3.

R1=R4=P1=P2=0.

In all cases, C1 and C2 are respectively the x and y coordinates of the starting point of the scan; and the number of points in each scan and the number of scans determine the third parameter. The values C1, C2, L, W, and H are scaled commensurate with the vidi field being 40000_8 x 40000_8 units in extent.

III. WHAT IS REALLY GOING ON

According to the ITS manual, .VSCAN generates a set of points (X2,Y2) within the unit square:

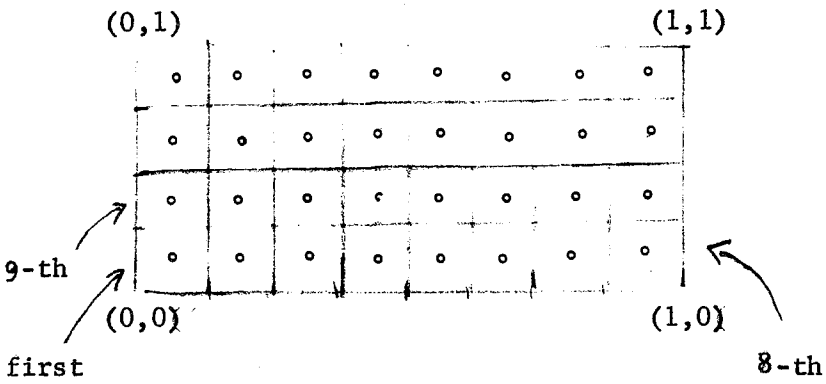

figure 4.

which has been divided into XRESxYRES equal sub-rectangles; and each point is in the center of a sub-rectangle. The order in which the points is generated is as in figure 4, namely the XRES points of the bottom row of rectangels is generated in left-right order, similarly the next-to-bottom row, etc. The coordinates given to the vidissector consist of these points, in the order generated, transformed by the transformation f(x,y):

(X2,Y2) f(X2,Y2) = (X,Y):

$$X = \frac{R1*X2 + R2*Y2 + C1}{P1*X2 + P2*Y2 + 1}$$

$$Y = \frac{R3*X2 + R4*Y2 + C2}{P1*X2 + P2*Y2 + 1}.$$

Evidently the images of (0,0),(1,0),(1,1) and (0,1) under this transformation become the points PT1, PT2, PT3, and PT4 as in figure 1.

Letting:

PT1 = (X1,Y1)

PT2 = (X2,Y2)

PT3 = (X3,Y3)

PT4 = (X4,Y4)

we have, from f(0,0) = (X1,Y1):

$$X1 = C1 \tag{1}$$

$$Y1 = C2; \tag{2}$$

from f(1,0) = (X2,Y2):

$$X2 = \frac{R1 + C1}{P1 + 1} \tag{3}$$

$$Y2 = \frac{R3 + C2}{P1 + 1} \tag{4}$$

from f(1,1) = (X3,Y3):

$$X3 = \frac{R1 + R2 + C1}{P1 + P2 + 1} \tag{5}$$

$$Y3 = \frac{R3 + R4 + C2}{P1 + P2 + 1} \tag{6}$$

and from f(0,1) = (X4,Y4):

$$X4 = \frac{R2 + C1}{P2 + 1} \tag{7}$$

$$Y4 = \frac{R4 + C2}{P2 + 1}. \tag{8}$$

letting:

(a,a') = (X2-X1,Y2-Y1)

(b,b') = (X4-X1,Y4-Y1)

(c,c') = (X3-X2,Y3-Y2)

(d,d') = (X3-X4,Y3-Y4),

the equations (1), ... (8) solve to:

$$C1 = X1$$

$$C2 = X2$$

$$P1 = \frac{ad' - a'd}{cd' - c'd}$$

$$P2 = \frac{cb' - c'b}{cd' - c'd}$$

$$R1 = X2P1 + a$$

$$R2 = X4P2 + b$$

$$R3 = Y2P1 + a'$$

$$R4 = Y4P2 + b'.$$

Note: If the transformation $\underline{f}$ is in fact carried out as stated in the ITS manual, then any point (X2,Y2) s.t.

$$P1X2 + P2Y2 + 1 = 0$$

transforms into randomness, since this gives a zero denomenator in the transformation formula. It is not clear if this can really happen, but may account for lossage in some situations.

APPENDIX

```
001
002          (DEFPROP EIGHTVPARAM(LAMBDA(PT1 PT2 PT3 PT4)
003           (PROG(A B C D P1 P2 C1 C2 R13 R24)
004            (SETQ PT1(SCALE PT1))
005            (SETQ PT2(SCALE PT2))
006            (SETQ PT3(SCALE PT3))
007            (SETQ PT4(SCALE PT4))
008            (SETQ C1(CAR PT1))
009            (SETQ C2(CADR PT1))
010            (SETQ A(VD PT2 PT1))
011            (SETQ B(VD PT4 PT1))
012            (SETQ C(VD PT3 PT2))
013            (SETQ D(VD PT3 PT4))
014            (SETQ P1(*QUO(DOT A(PERP D))
015                          (DOT C(PERP D)) ))
016            (SETQ P2(*QUO(DOT C(PERP B))
017                          (DOT C(PERP D)) ))
018            (SETQ R13(VSUM(SCALARPROD P1 PT2)A))
019            (SETQ R24(VSUM(SCALARPROD P2 PT4)B))
020            (RETURN(MAPCAR 'NELSON(LIST
021             (CAR R13)
022             (CAR R24)
023             C1
024             (CADR R13)
025             (CADR R24)
026             C2
027             P1
028             P2))) ))EXPR)
```

```
001
002
003          (DEFPROP PERP(LAMBDA(X)(LIST
004           (CADR X)
005           (MINUS(CAR X)) ))EXPR)
006
007          (DEFPROP SCALE(LAMBDA(X)
008           (SCALARPROD  16. X))EXPR)
009
010
011          (DEFPROP VD(LAMBDA(X Y)(MAPCAR
012           '*DIF
013            X
014            (VSUM Y '(0.0 0.0)) ))EXPR)
015
016          (DEFPROP VSUM(LAMBDA(X Y)(MAPCAR
017           'PLUS
018           '(0.0 0.0)
019           X
020           Y))EXPR)
021
022          (DEFPROP DOT(LAMBDA(X Y)(EVAL
023           (CONS 'PLUS(MAPCAR 'TIMES X Y))))EXPR)
024
025          (DEFPROP SCALARPROD(LAMBDA(X Y)(LIST
026           (TIMES X 1.0(CAR Y))
027           (TIMES X 1.0(CADR Y)) ))EXPR)
028
029          (DEFPROP NELSON(LAMBDA(X)(FIX
030           (TIMES 1000000 X)))EXPR)
031
032
033
```

```
001
002          (OPS MK(LSH -1000. 18.))
003
004          (OPS HUND(LSH 100. 18.))
005
006          (LAP VSCAN SUBR)
007                    (SYMBOLS T)
008                    (CALL    1 (QUOTE REVERSE))
009                    (MOVE    3 1)
010                    (MOVEI   4 7)
011          RT        (HLRZ    1 0 3)
012                    (HRRZ    3 0 3)
013                    (PUSHJ   P NUMVAL)
014                    (MOVEM   1 PARAMS 4)
015                    (SOJGE   4 RT)
016                    (*VSCAN  0 PTABLE)
017                    (MOVEI   1 NIL)
018                    (POPJ    P)
019          PTABLE    (0       0 3)
020                    (MK      0 ARY)
021                    (HUND    0 10.)
022          PARAMS    (BLOCK 8.)
023          ARY       (BLOCK     1024.) ()
```