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## Suggested Algorithm for medical Image Segmentation Using Fractal geometry

Texture extraction and analysis are regarded as important operations in image processing field for various computer applications.

In this research, fractional dimension has been used in the process of texture extraction and analysis of various medical images. 2D Variation and Box Counting algorithms were used to extract the textured image and segment the radiation image based on the extracted textures.

This research first adopted common and used methods in 2D variation algorithm, as well as a proposed method to adopt this algorithm. Practical experiments showed the efficiency of the proposed method in the process of texture extraction with execution time less than the time required by other common used methods.

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-1

. [27]

Texture )

(Segmentation

-2

(X-Ray)

1895

110

. [19] [6]

Magnetic Resonance Imaging

Ultrasound

:

(MRI)

:

.1

Fluoroscopy

.2

Mammography

.3

Computed Tomography (CT) Scan

.4

Ultrasound

.5

Angiography and Interventional

.6

Magnetic Resonance Imaging (MRI)

.7

(Fractal Geometry)  
(Benoit B. Mandelbrot)  
(Fractals)

[18].

(Fractal Geometry)  
( Self-Similar)  
( Scale Symmetric)

" "

:

(Scale Space)  
[2] (Scale Perspectives)

[11] (samples )

[11].

[9].

self-similarity

:

[11] self-affinity

...

" : (1989)

. [28] "

. [26]

. [24]

:

. ( ) (anisotropic)

:

) (isotropic)

. [28]

. (

**Dimensions -5**

. [20]

**Euclidean Dimension 1-5**

$D_E$

. [2]

**Topological Dimension 2-5**

[25]

. [7] (homeomorphism)

Hausdorff-Besicovitch Dimension

3-5

[20]  $N(r) = L_0 / r$

$$L = \lim_{r \rightarrow 0} N(r) \cdot r = \lim_{r \rightarrow 0} L_0 \cdot r^0 = L_0 \quad (1)$$

$$A = \lim_{r \rightarrow 0} N(r) \cdot r^2 = \lim_{r \rightarrow 0} L_0 \cdot r^1 = 0 \quad (2)$$

$$V = \lim_{r \rightarrow 0} N(r) \cdot r^3 = \lim_{r \rightarrow 0} L_0 \cdot r^2 = 0 \quad (3)$$

$$A = \lim_{r \rightarrow 0} N(r) \cdot r^2 = \lim_{r \rightarrow 0} A_0 \cdot r^0 = A_0 \quad (4)$$

$$V = \lim_{r \rightarrow 0} N(r) \cdot r^3 = \lim_{r \rightarrow 0} A_0 \cdot r^1 = 0 \quad (5)$$

$$L = \lim_{r \rightarrow 0} N(r) \cdot r = \lim_{r \rightarrow 0} A_0 \cdot r^{-1} = \infty \quad (6)$$

$r \rightarrow 0$

### 2D Variation Method

-6

[21]  $r$

$r$

$N(r)$

3  $r$   $r$   $r$

$\ln(r)$   $\ln(N(r))$   $S$

: [29]

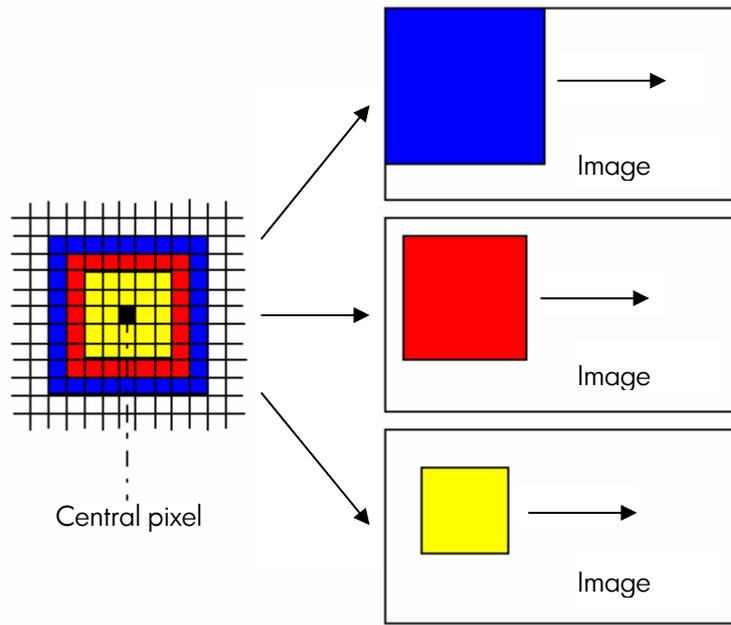
$$D = 3 - (S/2)$$

(7)

$D$

$S$

(1)



:(1)

-7

[13] (1997)

\*

Bone

Mineral Density BMD

Quantitative computed

. CT

tomography QCT

"

[8] (2005) Fei Gao

\*

"

colposcopic

cervicographic

Acetowhite

"

[10] (2007)

Huajun Ying

\*

"

"

[4] (2007)

\*

"

.(%75)

[23] (2005) Sheng-Chih Yang

\*

"

"

Probabilistic

Neural Network

...

PNN

" [7] (1998) E-Liang Chen \*

"CT

Modified Probabilistic  
.CT

Fractal Geometry  
Neural Network (MPNN)

MPNN

-8

"Texture"

وبعضها أولية إحصائية على سبيل

المثال

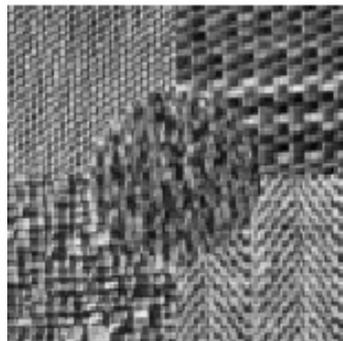
:

[5].

( )

.visual texture

(2) [2].



(2)

1-8

: [14]

:

( )

( )

( )

:

.texels

(1

(2

(3

(4

(5

(6

. [14]

2-8

. [15] [2]

fractal-based features

.co-occurrence features

:[17]

\*

\*

textons texels

**Texture description 3-8**

:-

Statistical method .1

Psychophysical method .2

Structural method .3

Model Based method .4

Signal processing method .5

Patch-based method .6

**Texture Detection 4-8**

(c) (b) (a) (3)

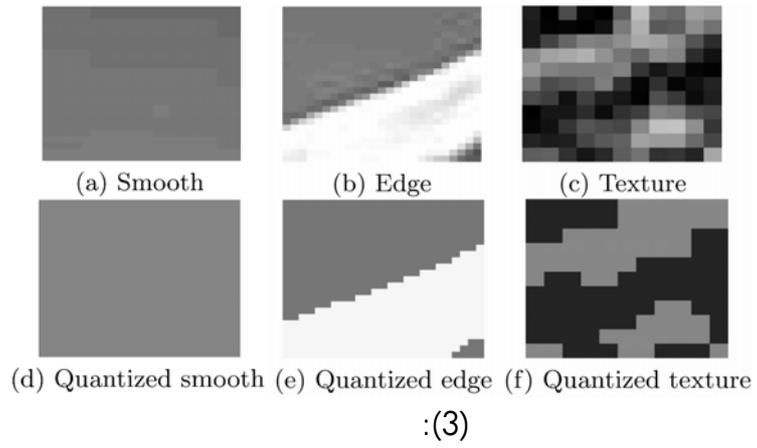
((d) - (f) 3) .[22]

((a) - (c) 3)

Component -count local

-  
description of texture

(clustering)



...

( )

. .1

. .2

. .3

. .4

. .5

.1 .6

0

.7

=

=

/

Image Segmentation

.( )

) -:

) ( )

(reproducibility

.[12] (

:

.

.

. [17]

(Object)

,[2]

(Class)

(Homogeneity)

:

(Borders)

, ( )

:

(Image Segmentation Methods)

-10

:

. [17]

. [17]

Region Growing & Shrinking

-

[16] [2]

-1

-2

-3

-4

-5

Clustering Method

-

( Histograms )

:[2]

-1

( Peak )

-2

-3

.( )

( 3 1 )

-4

Fractal Segmentation Method

-

(Object)

,(Border)

(Resolution)

.[2]

Tow Dimension

Box Counting

.[21] Variation

.[1] (Binary Images)

-11

255 0

-12

(1) (1)

-

.(2D Variation Method for Grayscale Image)

$h \times w$   $M$  .1

$r_{max}$  .2

$r = \{3, 5, \dots, r_{max}\}$

.(1)  $i, j$  .3

$r_{max} \times r_{max}$  *Wind* .4

$z = (r_{max} - 1)/2$

$i_p = z + i$  ,  $j_p = z + j$   $P(i_p, j_p)$



-4

-5

( )

-6

-7

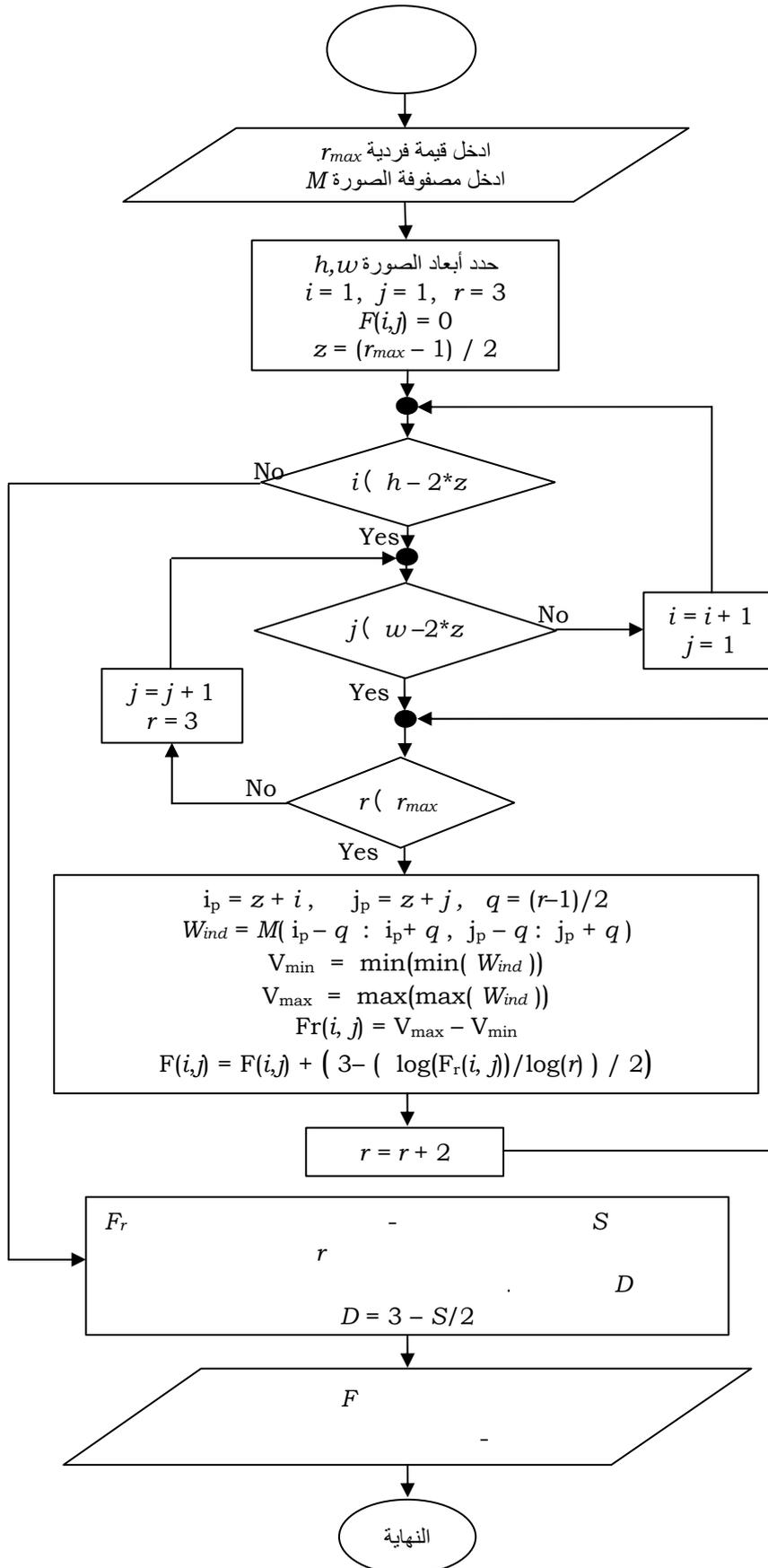
-8

-9

- ... \_\_\_\_\_
- " 2004 [1]
- " [2]
- " 2002 [2]
- " [3]
- " 2009 [3]
- " [4]
- " 2007 [4]
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## الملحق (1)



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OPG

( 2 ) (1)  
.OPG

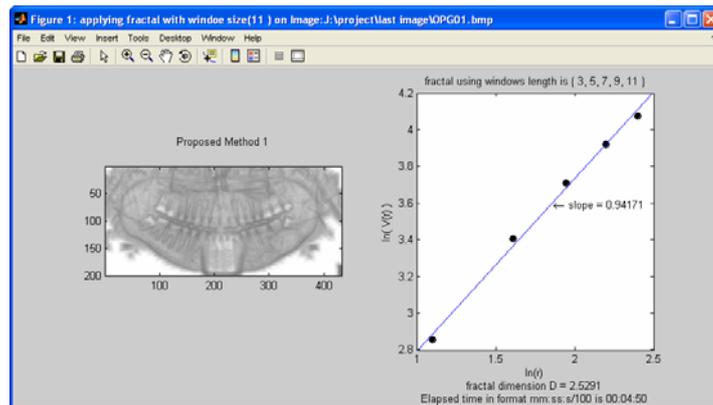
( 2 ) (2)  
. (255-0)



( ) ( ) OPG : (2)

( 2 ) (3)

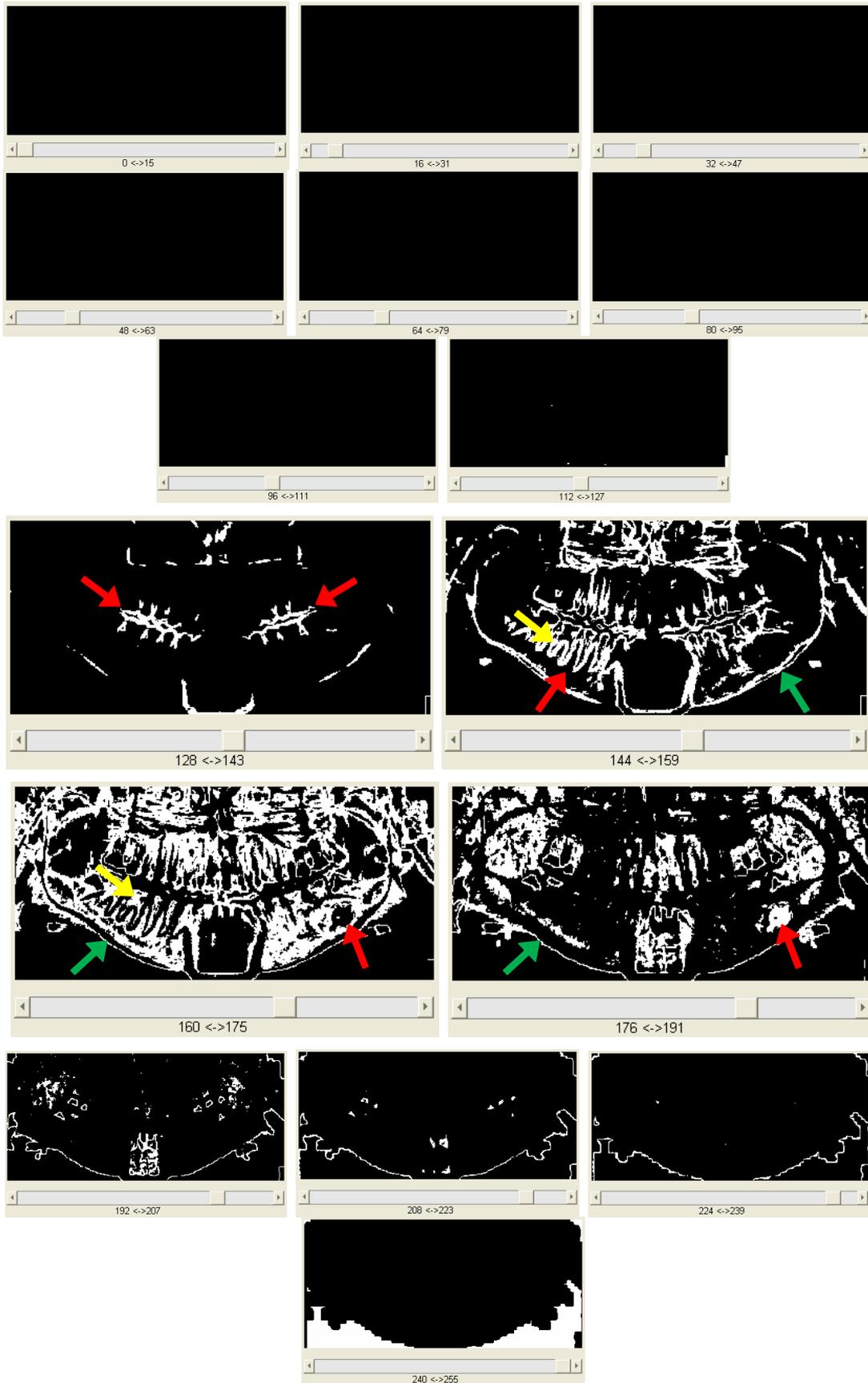
. {3, 5, 7, 9, 11}  
. (3)



{11 9 7 5 3} : (3)

16 (4) (4)

( 16 )



( 2 )                      16                      16                      :(4)

-: (112↔127)

(128↔143) (

(144↔159) (

(160↔175) (

(176↔191 160↔175) (

(5

(5)

(6)

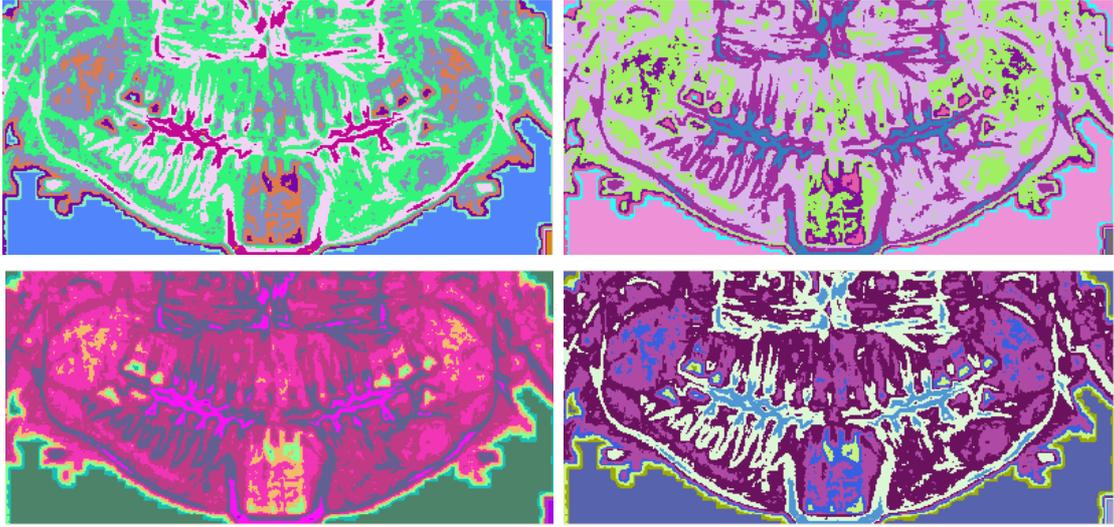
64

(6

(7

(7)

64



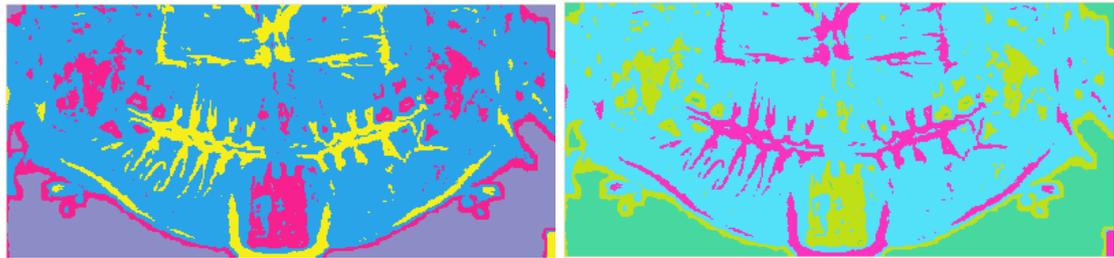
(5)

16



64

(6)



64

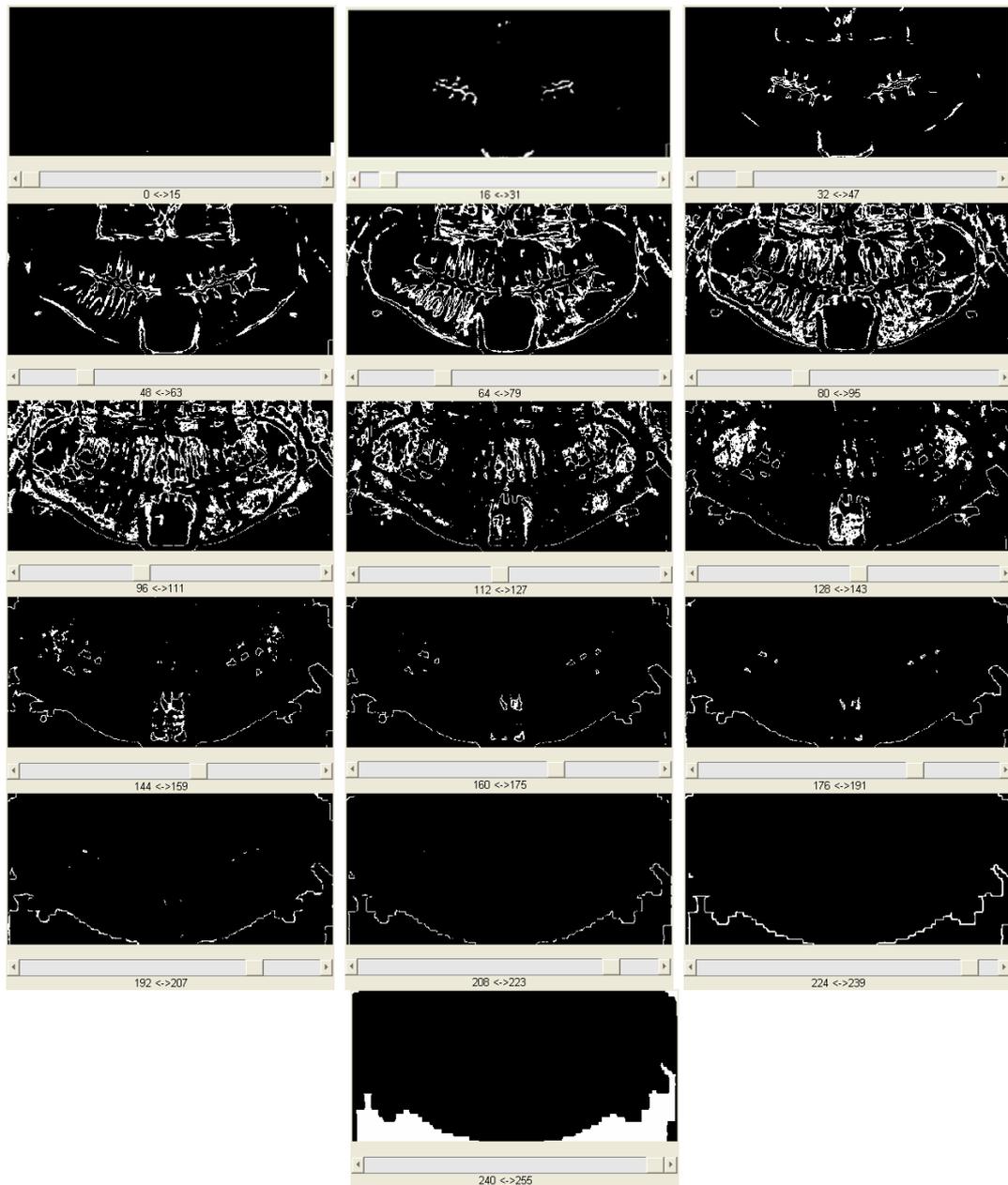
(7)

16 )

16 (8)

(8

(



16 (2) 16 : (8)