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:

Mammogram ( ) .[1]  
X  
X-ray .

[2]  
.[3,4]

.

[5]

Spatial

[6,7,8] Density

[ ]

:

.(CAD )

.

[ ] Wavelet Transform

[ ]

[ ]

[١٦٤١٧٤١٨]

[٢٠]

[١٥]

[١٩]

(١)

"L"

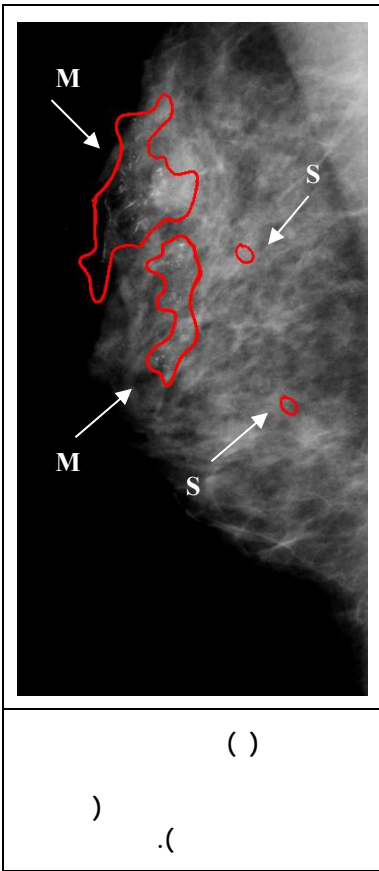
Local Database

"C"

.Common Database

				(%)	
		( $\mu\text{m}$ )	(bits)		
Papadopoulos, (٢٠٠٢)	٤٠ (C) ٢٠ (C)	٥٠	٨	٩٠	١,١٥
Zheng, (٢٠٠٢)	٤٠٠ (L)	١٠٠	١٠	٨٠	٠,٢
Bazzani (٢٠٠٠)	٤٠ (C)	١٠٠	١٢	٩٥	٠,٦
الخوارزمية المطورة	٦١ (L) ٢٣ (C)	١٠٠	٨	٩١ (٩٥M,٨٦B) ٩٦ (١٠٠M,٩٢B)	٠,٣٣ ٢,٣٩
Nagel (١٩٩٨)	٥٠ (L) IS ٥٠ (L) ID	١٠٠	١٠	٨٣	٠,٨ ١,٩
Ibrahim (١٩٩٧)	٤٣ (C)	١٠٠	٨	٩٥,٨	١,٨
Karssemeijer (١٩٩٧)	٤٠ (C)	١٠٠	١٢	٩٥	١
Chang (١٩٩٧)	٣٨٦ (L)	١٠٠	١٢	٨٩,٥	٠,٣٩
Gurcan (١٩٩٧)	٤٠ (C)	١٠٠	١٢	١٠٠	٣,٣

( )



Lumiscan

[ ]  
( )

Pixel

µm

. Byte

Depth

Abnormal

Truth Outlines

( )

)

.(

( )

(M)

.(S)

Isolated Calcifications

(

) Normal

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Biopsy  
Benign Malignant  
Local  
Mammographic Image Analysis Society (MIAS)  
 $\mu\text{m}$  Byte  
Interactive Data Language (IDL)  $\mu\text{m}$   
IDL DELPHI

### The Algorithm Structure


Image Analysis

⋮  
\_\_\_\_\_

L S S L

Image Texture Analysis

(γ) [γ³, γ⁴]

$\begin{bmatrix} -1 & 0 & 2 & 0 & -1 \\ -4 & 0 & 8 & 0 & -4 \\ -6 & 0 & 12 & 0 & -6 \\ -4 & 0 & 8 & 0 & -4 \\ -1 & 0 & 2 & 0 & -1 \end{bmatrix} = S5L5$		$\begin{bmatrix} -1 & -4 & -6 & -4 & -1 \\ 0 & 0 & 0 & 0 & 0 \\ 2 & 8 & 12 & 8 & 2 \\ 0 & 0 & 0 & 0 & 0 \\ -1 & -4 & -6 & -4 & -1 \end{bmatrix} = L5S5$
<p>.S L ( - )</p>		<p>.L S ( - )</p>

Texture

[γ°] TA

Image

⋮

Spatial Feature Analysis

Contrast Texture Energy (CTE)

(1-1)

$$(1) \quad CTE = \sum_{j=1}^M Z_j^2 \frac{his(Z_j)}{N}$$

⋮

Distinct Texture Intensities

M

N

$Z_i$

$$\frac{his(Z_j)}{N}$$

( - ) ( - )

TA

[Y]

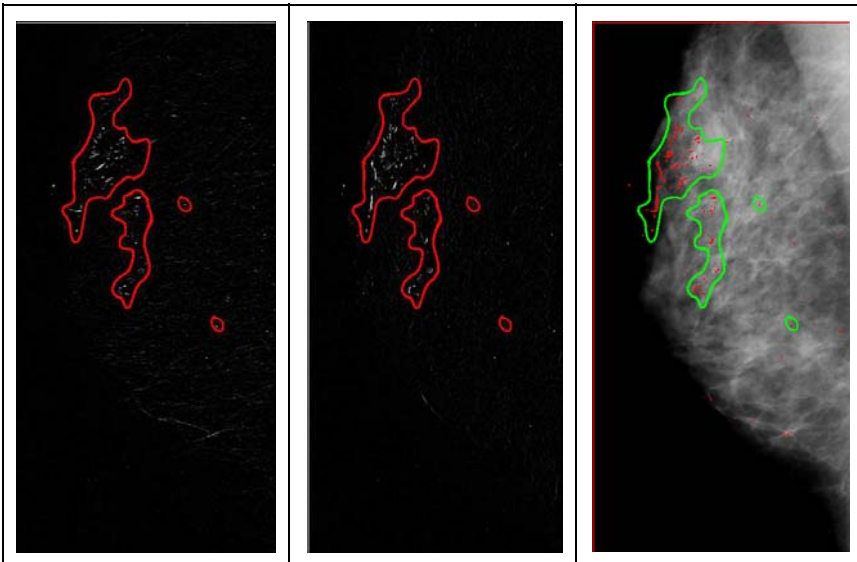
(Y)

CTE

(Pixel)	CTE
pixel	
pixels	
pixels (linear)	
pixels (corner)	
pixels (orthogonal)	

CTE

(Y)





(-)	(-)	(-)
L S	L S	( )

CTE= ( ) :

CTE= ( - )

( )

:

Morphological Closing

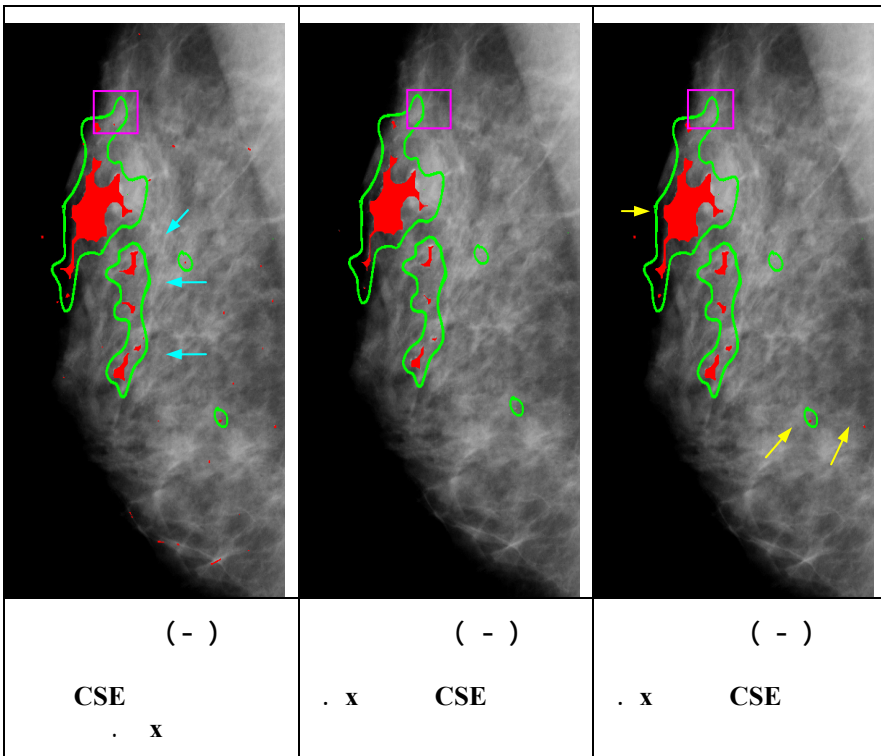
x Circular Structure Element (CSE)

( ) mm

) mm

CSE  
( -  $\xi$  ) . (

( -  $\tau$  )  
( ) )  
.( ( ) )



CSE Morphological Erosion

. x  
( - ε)

x CSE Morphological Dilation

( - ) .

.Benign Calcification

. x  
x CSE : \_\_\_\_\_

(-1 :

(-2

(- ) .

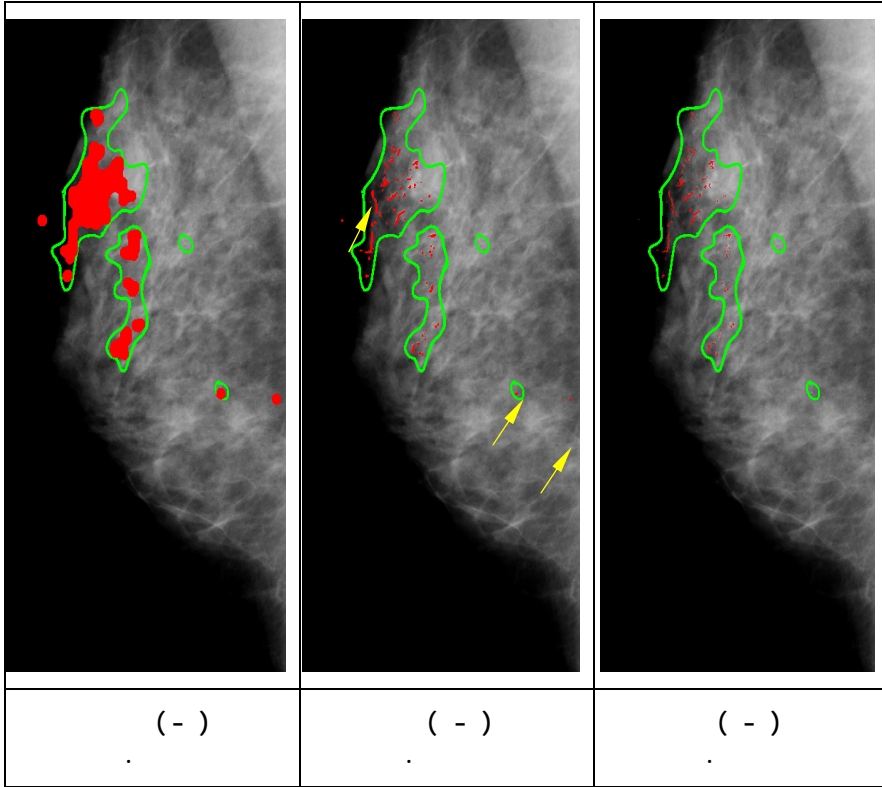
(-5)

AND

.( -3)

( - )

.( )



cm ( )  
 -o) .[YV]

(ج)

( - )

:

CTE= ( )

Sensitivity × CSE

Rate of False

.Positive Responses Per Image

Specificity ( )

(٣)

.CAD

نتائج الخوارزمية Algorithm's Performance		
دقة الكشف Sensitivity (Malignant + Benign)	معدل الاستجابات الخاطئة False Positive Responses Per Image	دقة تجنب الخطأ Specificity
٩١٪ (٩٥,٢٪ + ٨٦,٥٪)	١,٠٢	٨٤٪

(٣)

.MIAS

bits

$\mu\text{m}$

(٤)

$\mu\text{m}$

.(CTE= , CSE= x )

نتائج الخوارزمية Algorithm's Performance		
دقة الكشف (Malignant + Benign) Sensitivity	معدل الاستجابات الخاطئة Rate of False Positive Responses Per Image	دقة تجنب الخطأ Specificity
٩٦,٤٪ (١٠٠٪ + ٩٢,٣٪)	٢,٣٥	٣٣٪

.MIAS

:(٤)

(٣)

(٤)

[٢٨]

[٢٩] CAD

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CAD

[19]

CSE

CTE

(1)

( )

.[ [ ] )

( - )

[19]

Receiver Operating Characteristics Curve (ROC)

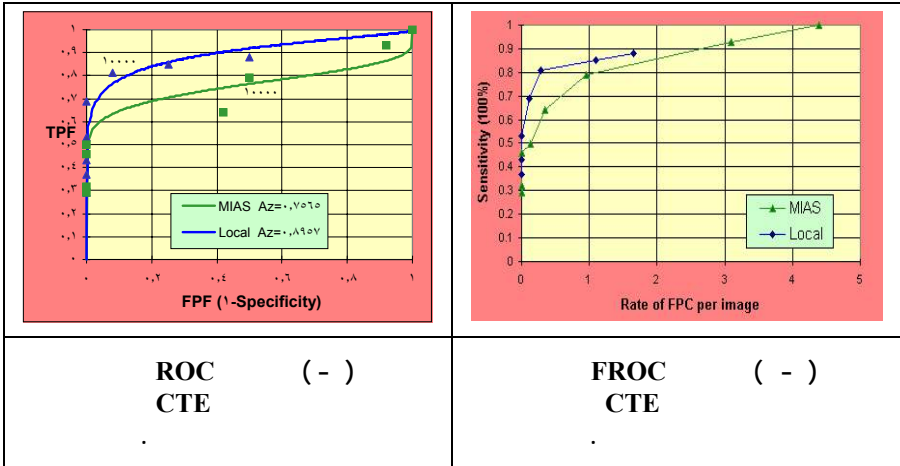
ROCFIT

CTE

.www-radiology.uchicago.edu./krl/toppage .htm

[ ]

ROC



( - 6 )

Free Response Operating Characteristics Curve (FROC)

( )



- - -



.( )

Objects

[4]

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Threshold

cm

CSE

(

)

)

(

)

.(

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