

Computerized) (CT)

(Magnetic Resonance Imaging)(MRI)

(Tomography)

%85

%80

Brain Tumors Segmentation Based On Genetic Algorithms

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Abstract

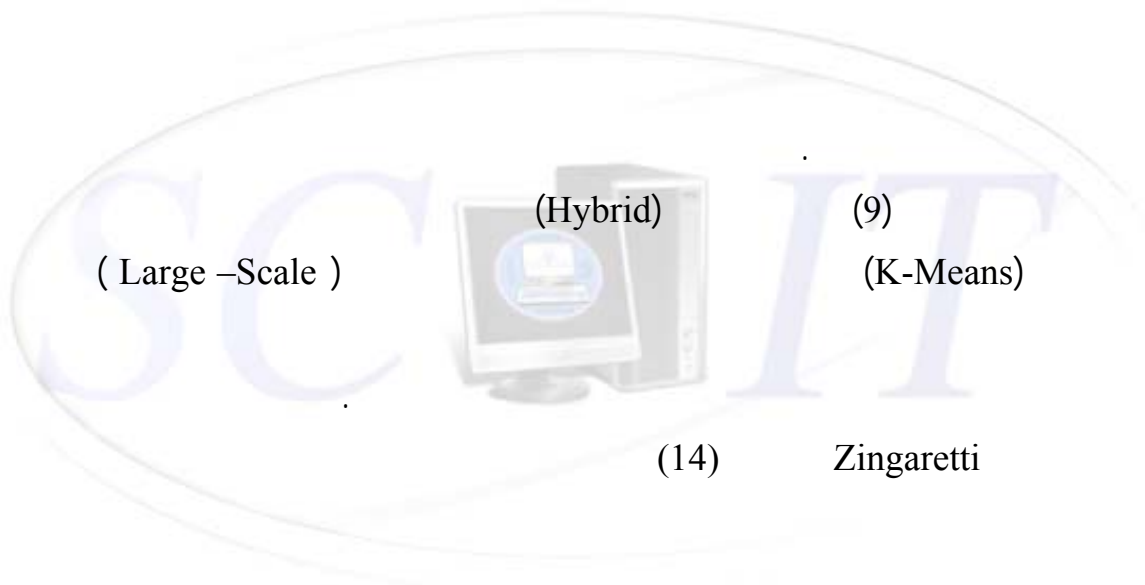
In this research, the brain images resulting from computerized tomography (CT) have been used in order to determine the tumor area in the brain. the steps started by preprocessing operation to the image before inputting it to algorithm .the image was converted to binary image in order to segment the image, later on into equal segments ,then the correlation coefficient was found among these segments ,these values used as fitness function in the genetic algorithm in order to differentiate between segments ,the result of the genetic algorithm was segment numbers which will be merged to form the sub-images ,then continuing these steps till determining the tumor approximate location. Another approach of image segmentation has been used without using the genetic algorithm by choosing the segments though a certain condition not randomly. Satisfying results have been reached in both approaches, but in different execution times. In both approaches tumor location was determined approximately, as a result the genetic algorithm was succeeded in about 85% while the first algorithm determine 80% of tumor locations.

-1 :

(2)

(3)

(6)



K-Means

(13)

(Vector Quantization)

(Pariwise Nearest Neighbour)

(11)

(6)

(4)

%100

(Correlation)

Images Filters

-2

(Mask)

(5x5) (3x3)

(5)(Correlation)

(Convolution)

Thresholding

-3

(7) (5) : (Threshold value)

$$f(x, y) = \begin{cases} 1 & \text{If } (x, y) \geq \text{Threshold} \\ 0 & \text{Otherwise} \end{cases}$$

$$\text{Threshold} = \frac{1}{w * h} \sum_{x=1}^h \sum_{y=1}^w f(x, y) \quad [1]$$

:

: w

: h

(Horn , 2001) .

: f(x,y)

(1)



(1)

: -4

(Contrast)

(Homogeneity)

(12)

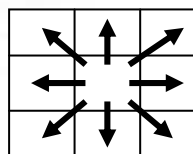
:

-
-
-
-

: Connectivity

1-4

: (2)



(2)

2-4

:

: Bounding Detection (1)

. ()

:

: Clustering (2)

: (Region Growing Shrinking) (3)

.(Row Col. Based Image Space)

: -5

: (1)

- COMPUTERIZED TOMOGRAPHY (CT) X_RAY
- ULTRASOUND
- MAGNETIC RESONANCE imaging (MR)
- DIGITAL X_RAY ANGIOGRAPHY (DSA) X
- Functional MAGNETIC RESONANCE imaging(FMRI)

1-5

(8)

()

MR

PET

(16) :Correlation

-6

f(x,y)

f

h(x,y)

f(x,y), h(x,y)

$$F(x, y) \circ H(x, y) = 1/(mn) \sum_{m=0}^{m-1} \sum_{n=0}^{n-1} f^*(m, n) h(x+m, y+n) \quad [2]$$

f

f

f*

:x

:y

F(x,y)

: H(x,y)

: O

:

1-6

m*n

f(x,y)

j*k

w(x,y)

:

j<=M, k<=N

$$c(x, y) = \sum_s \sum_t f(s, t) w(x+s, y+t) \quad [3]$$

$x=0,1,2,\dots,m-1$,s:

$y=0,1,2,\dots,n-1$,t:

$s_0=$

$t_0=$

w

F

.c

(3)

(x_0, y_0)

w

()

$c(x,y)$

w

F

x,y

w,f

:

$$\hat{d}(x, y) = \frac{\sum_s \sum_t [f(s, t) - \bar{f}(s, t)] [w(x+s, y+y+t) - \bar{w}]}{\sqrt{\sum_s \sum_t [f(s, t) - \bar{f}(s, t)]^2 \sum_s \sum_t [w(x-s, y+t) - \bar{w}]^2}} \quad [4]$$

$\hat{d}(x, y)$

m2,1,0 : x

n.....2,1,0 : y

W

: W

.1 1-

-8

: Gene

: Chromosome

:Chromosome length

: Population size

: Individual

: Genotype

: Phenotype

: -9

. 1975

Standard Genetic Algorithm

Initialization [population] ;

Evaluation [population] ;

Gen :=0;

do

Selected_ parents := Selection[population] ;

Created_offspring := Recombination [Selected_parents] ;

Mutation [Created_offspring];

Population := Created_offspring ;

Evaluation [population] ;

Gen := gen +1 ;

Until Stop Criterion ;

(15): -10

$$\text{cov}(x_i, x_j) = \sum_{m_i, m_j} (x_i - m_i)(x_j - m_j) \quad [5]$$

m_i, m_j

x_i, x_j

i, j

A_{ij}

1+ 1-

$$\text{corr} (x_i, x_j) = \text{cov} (x_i, x_j) / \sigma_i \sigma_j \quad [6]$$

: x_i

: x_j

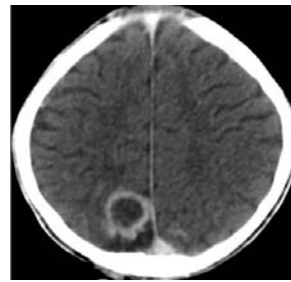
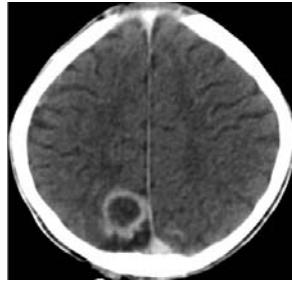
i : σ_i

j : σ_j

-11

: (3)

(BMP)

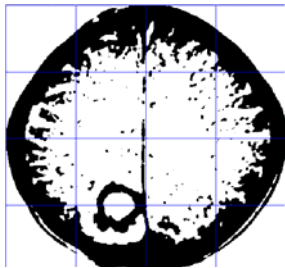


الشكل (4) صورة من نوع (Gray Level)
لدماع الانسان

الشكل (3) صورة من نوع (BMP)
لدماع الانسان

(4) (Gray level)

(Binary Image)



(3-4)

الشكل (6) 16مقطع لصورة نوع (Binary image)
لدماع الانسان

الشكل (5) صورة من نوع (Binary Image)
لدماع الانسان

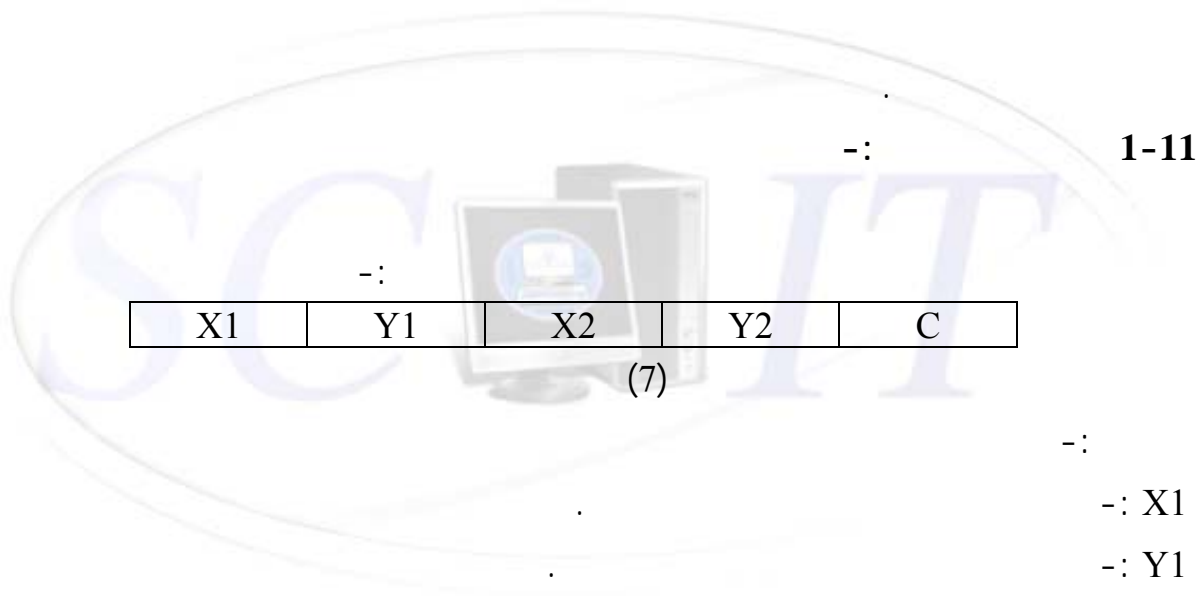
(6)

(16) 4*4

(Correlation Values)

(16)

(Sub-image)



X1	Y1	X2	Y2	C
----	----	----	----	---

(7)

- :
- 1-11
- : X1
- : Y1
- : X2
- : Y2
- : C

2-11

(8)

(16)

-:

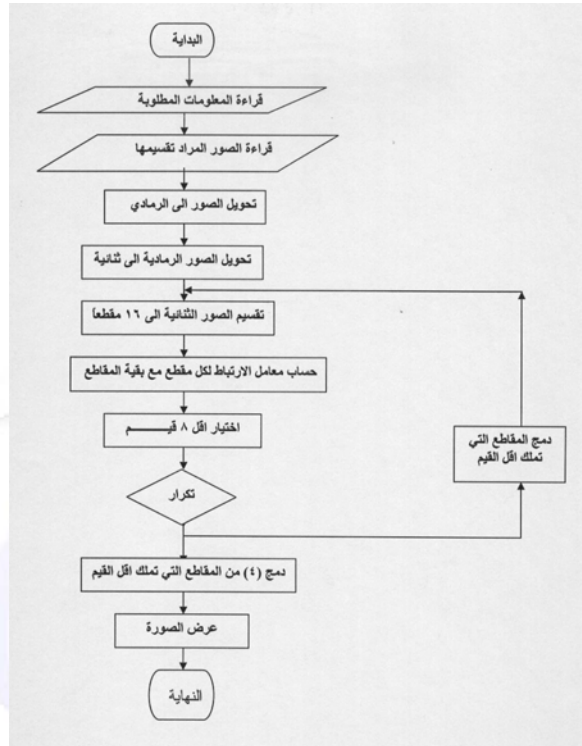
(8) .1

.2

.3

-(16)

(4)



(8)

-(

2-11

(Steady Genetic Algorithm)

thresh

(16)

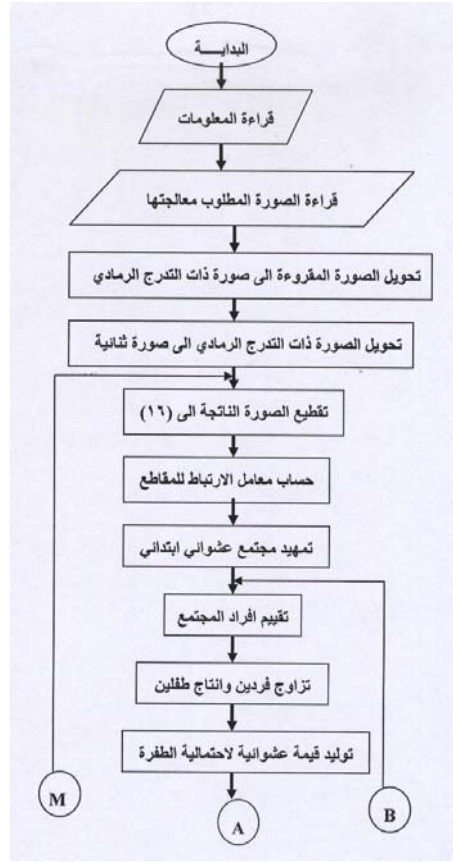
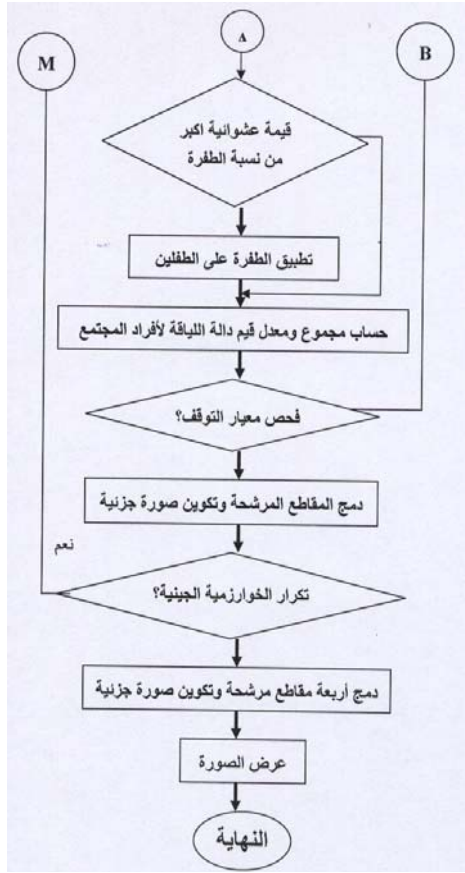
(Mean- Filter)

(4)

(4)

(8)

(9)



(9)

: -10

1-10

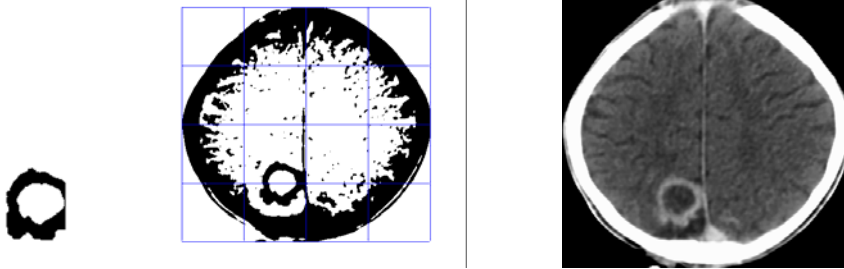
(1)

14.0313	a
20.1719	b
19.7969	c
17.8906	d

()

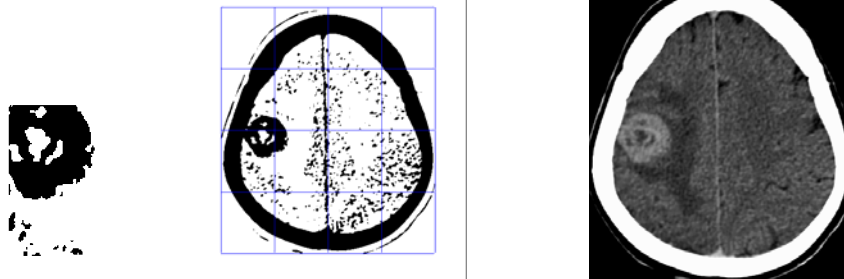
()

() (10)



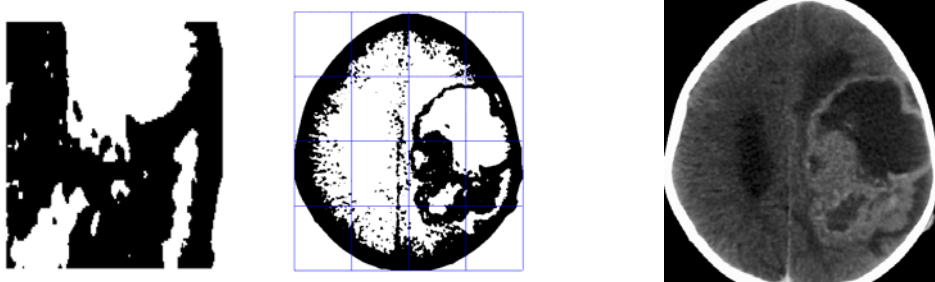
(أ) الصورة الاصلية (ب) الصورة (a) الثنائية (ج) صورة الورم

شكل (10) الصورة (a)



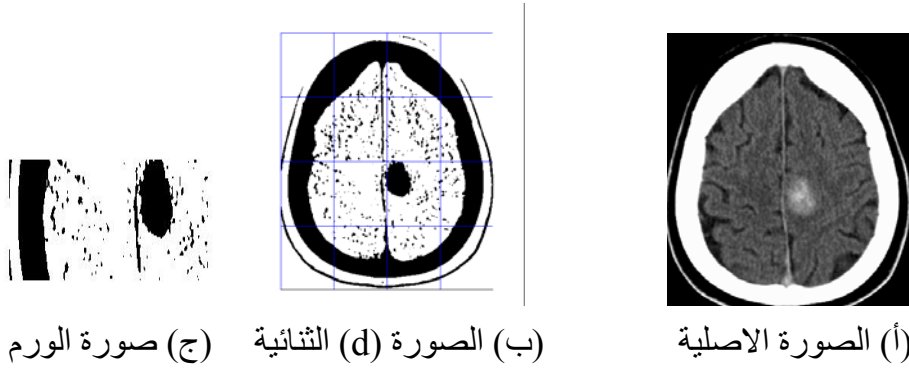
(أ) الصورة الاصلية (ب) الصورة (b) الثنائية (ج) صورة الورم

شكل (11) الصورة (b)



(أ) الصورة الاصلية (ب) الصورة (c) الثنائية (ج) صورة الورم

شكل (12) الصورة (c)



(أ) الصورة الاصلية (ب) الصورة (d) الثنائية (ج) صورة الورم

شكل (13) الصورة (d)

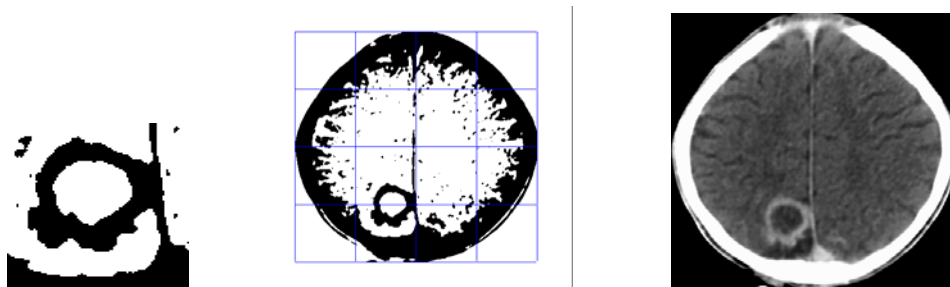
:

2-10

:

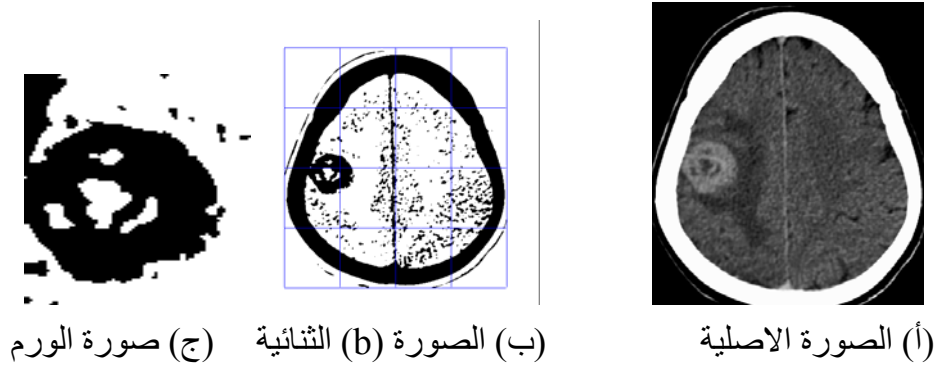
(2)

24.31458	a
28.5896	b
23.6589	c
20.5712	d



(أ) الصورة الاصلية (ب) الصورة (a) الثنائية (ج) صورة الورم

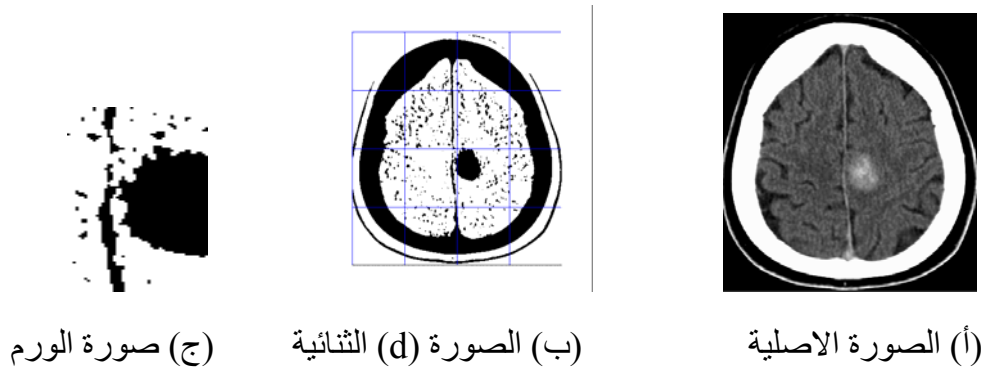
شكل (14) الصورة (a)



شكل (15) الصورة (b)



شكل (16) الصورة (c)



شكل (17) الصورة (d)

-20

.1 : 2001

Hamming-Maxnet

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