**   *

:

(24)

/   ,

(   ),

Global   Mapper v.7   .

,

C++ v.3

(E.C)   .

Classification of groundwater type, pilaspi quality by using Kohonen neural network

Hutheyfa Hazem Taha   **Mohammed Zaed Hussein**

ABSTRUCT:

In this research, classification of(24) wells in the aquifer of water existed within the Pilaspi Geology Formation in the Bashiqa area / North of Mosul, by using one of the types of artificial neural networks and specifically (kohonen network),by depending on groundwater quality. Where achieved the use with some the software of the computers, including Global Mapper v.7, which had been determine the wells locations for the groundwater on the topographic map of the research area according to the latitude and longitude coordinates for utilization from it is statistical in the classification process, Also we use's software C++ v.3, who is use Programming of Kohonen network for the classification of those wells with intelligence technology to groups according to Electric Conductivity (E.C) in the water.

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(1)

(36 20 00 - 36 30 00)

.   (43 10 00 - 43 30 00)

(25)

(Bashiqa Anticline)   (   )

(2)   ,² (315)

.(Global Mapper V.11)

.

Confined)

.(2000 ,   ) (Aquifer

.(Todd, 1980)

,

.(2010 ,   )
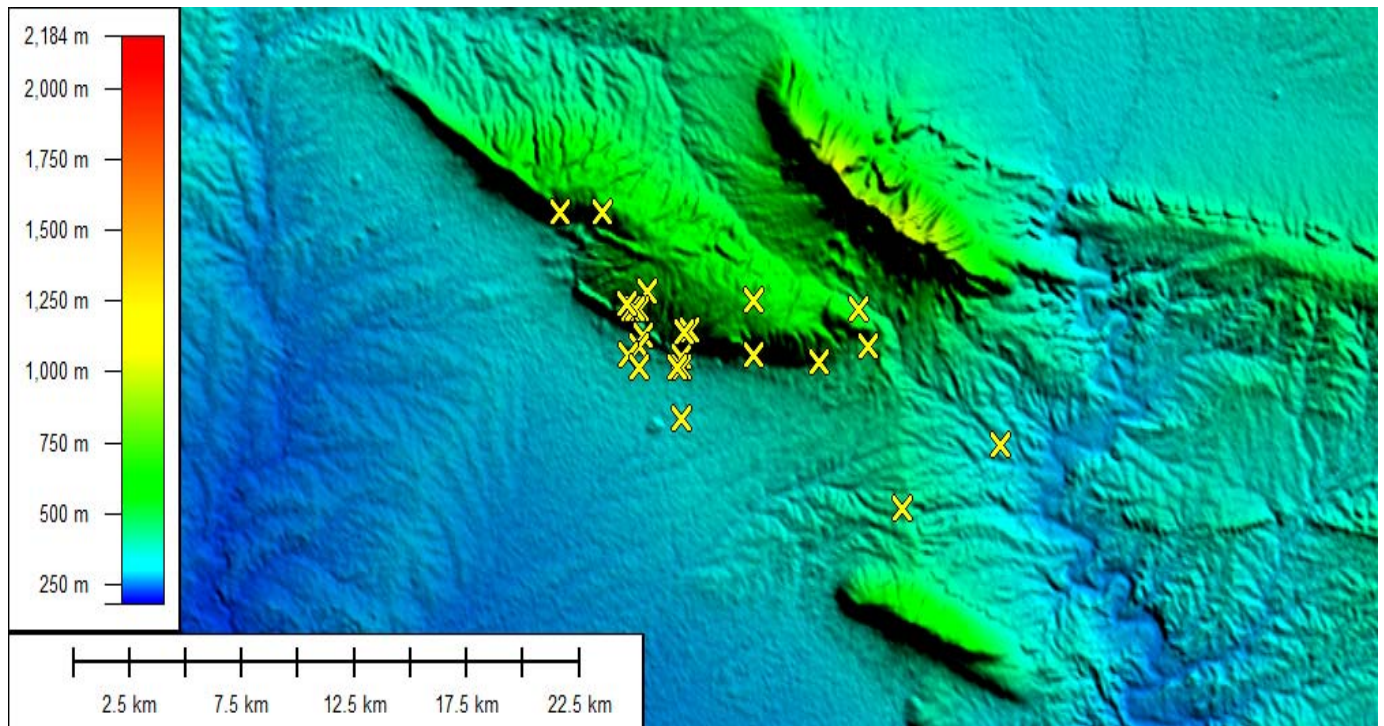
.

...

,

.

,

,   (Parson Company, 1955)

(Ingra Company, 1967)

,

(Numan and Bakose, 1985)

(1999   )   ,

(2000   )   ,

.

1-

(1:100000)   .(1)

2-   (DEM)

(Global Mapper v.11)   (Gps)

.

.(2)

,

(24)

.(3)   (Global Mapper V.11)

3-   (C++ v.3),

,

Object Oriented Programming (O.O.P).

:(1)
1 : 100000
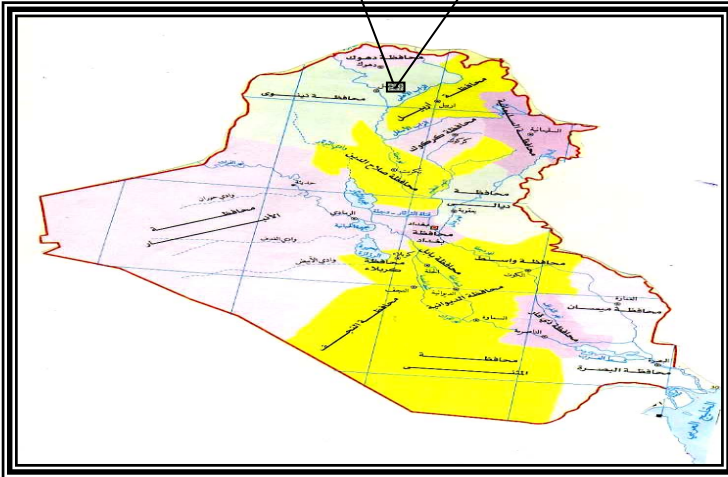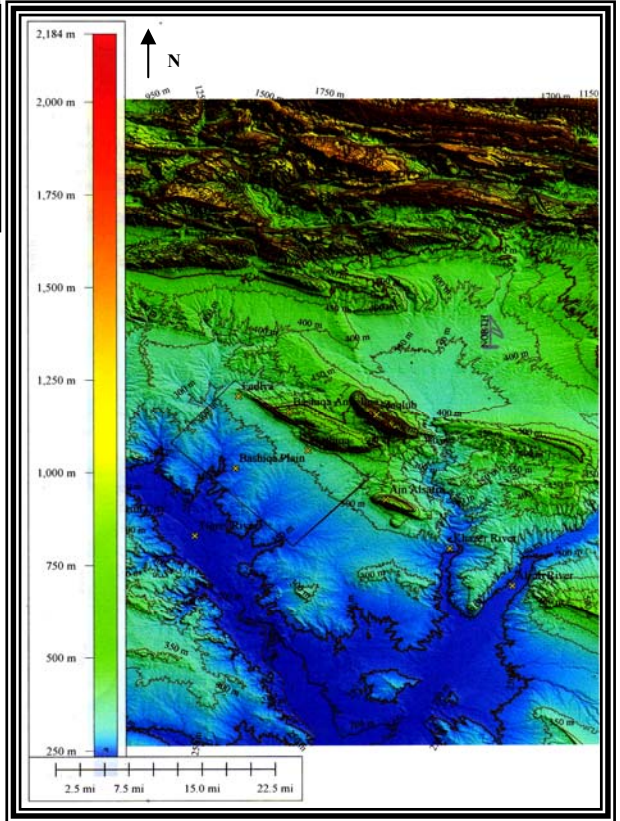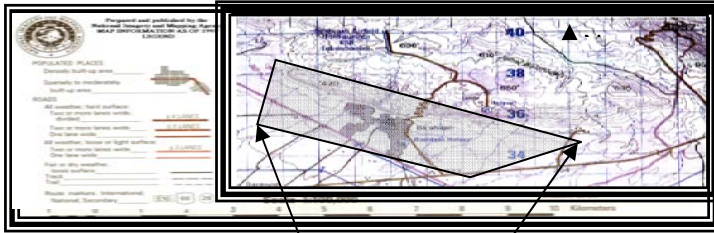
:(2)
(   )

:(3)

X : Pilaspi well

...

(1)

.

:(1)

Date	T.D.S (/)	E.C (/)	Draw down static(s)	Yield ( )	Static ( )	Depth ( )	Latitude			Longitude			No.
							"	'	O	"	'	O	
1976	360	509	32	11,2	18	124	0	30	36	36	18	43	1
1977	570	700	1,5	11,2	3	84	42	27	36	36	20	43	2
1978	737	959	5	17	22	127	30	28	36	42	20	43	3
1978	850	900	2	9	25	102	30	27	36	30	20	43	4
1979	360	450	3	16,5	21	145	12	28	36	30	20	43	5
1980	650	700	9	12	26	112	12	28	36	18	20	43	6
1981	2010	2250	63	3,7	25	246	20	27	36	15	20	43	7
1989	386	460	22	8,6	18	115	12	28	36	24	20	43	8
1990	460	500	23	3,5	3	180	6	27	36	30	20	43	9
1994	682	941	22	9	22	120	18	27	36	30	21	43	10
1995	1150	1230	21	5,8	30	190	6	27	36	30	21	43	11
1995	1230	1500	21	5,8	30	190	48	27	36	42	21	43	12
1996	760	850	7	10,5	26,5	110	10	26	36	30	21	43	13
1997	1340	1500	9	15	19	229	20	28	36	15	23	43	14
1998	220	350	25	6,75	35	132	20	27	36	15	23	43	15
1998	630	750	8	2,25	42	100	12	27	36	48	24	43	16
1999	441	838	12	17	15	100	18	28	36	12	20	43	17
1999	740	850	10	3	72	155	30	27	36	0	26	43	18
2000	1000	1100	1	5	103	200	30	24	36	48	26	43	19
2000	650	772	40	3	78	100	40	25	36	10	29	43	20
2001	260	360	10	12	28	146	45	27	36	35	21	43	21
2001	750	860	10	11,25	48	120	12	28	36	45	25	43	22
2002	950	1120	5	16,5	24	120	6	27	36	25	21	43	23
2002	522	682	8	11,2	22	104	0	30	36	36	19	43	24

:

1-

(/   )   (T.D.S)   (Total dissolved Solid),

(2)

.(Hem, 1971)

(2):   (T.D.S)   (/   )

Water Class	Concentration
Fresh	Less than 1000
Moderately Saline Brine	3000 – 10,000
Very saline	10,000 – 35, 000
Brine	Over 35,000

2-

(/   ) (Mho\cm)   (E.C)   (Electric

(Conductivity

:(Todd, 1980)

T.D.S = 1.5 (E.C) $\times 10^6$ ...(1)

(3)   (E.C) (Wilcox, 1955).

(3):

250	
250-750	
750-2000	
2000-3000	
3000	

[594]

...

(E.C)   (T.D.S)   (T.D.S)

(E.C),   (E.C)

.

:

1-

(2000 ,   ),

(E.C)   [0-250] (/   ) .

2-

(Total dissolved Solid)

(2000 ,   ).   (E.C)

[250-2000]

.

3-

,

(2000 ,   ),   (E.C)

.[2000-4000]

(Unsupervised

(training   ,   (Target Output)

.   (Target)

(Target)

.

(Teuvo Kohonen)

(1982)

.(2002 ,   )

,

,

[595]

(Winning Node)

.

(Self Organization Map)

.(2002 ,   )

,(Clustering)   (Data Mining)

.(2001 ,   ) (High Dimensional)   (   )

(   )

(Input Layer)

(Output Layer)

(Kohonen Layer)

(The Competitive Layer)   :   (4)

:(4)

...
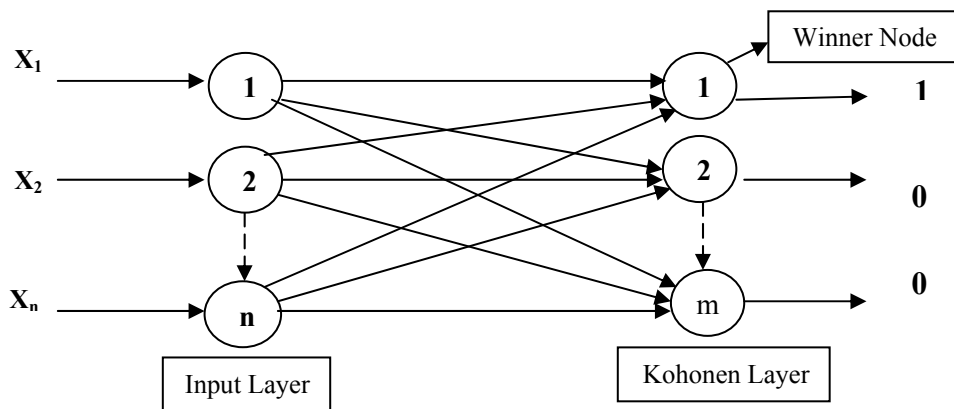
(Unsupervised)   (Cluster)

,   (Cluster)

(Target) (، 2002).

:

(2) (، 2002):

2 = ... (2)

( )

.

.

(، 2002)

:

Optimal number of cluster= Fix (log$_2$ no. (Input))   …. (3)

(3)

, :

= ((24)$_2$)   =

6 = (5.213)

(5):

```
                          ┌─────────────┐
                         (     Start     )
                          └──────┬──────┘
                                 │
                                 ▼
                    ┌────────────────────────┐
                    │  Variable initialization │
                    └────────────┬───────────┘
                                 │
                                 ▼
                    ╱────────────────────────╲
                    ╲     Read Data File       ╱
                     ╲────────────┬──────────╱
                                  │
                                  ▼
                    ◇────────────────────────◇
Loop 1              ◇      No. Cluster 2-6     ◇
                    ◇────────────┬───────────◇
                                 │
                                 ▼
                         ┌────────────┐
                         │  Learning   │
                         └──────┬─────┘
                                │
                                ▼
                         ┌────────────┐
                         │   doing     │
                         └──────┬─────┘
                                │
                                ▼
 ┌──────────────────────┐  ╱──────────────╲
 │ No. Cluster=No.Cluster+1│ ╲ Write results to ╱
 └──────────────────────┘  ╲   Output file   ╱
                             ╲──────────────╱

                          ┌─────────────┐
                         (      End      )
                          └─────────────┘
```

(5):   **2   6**

)

((5)
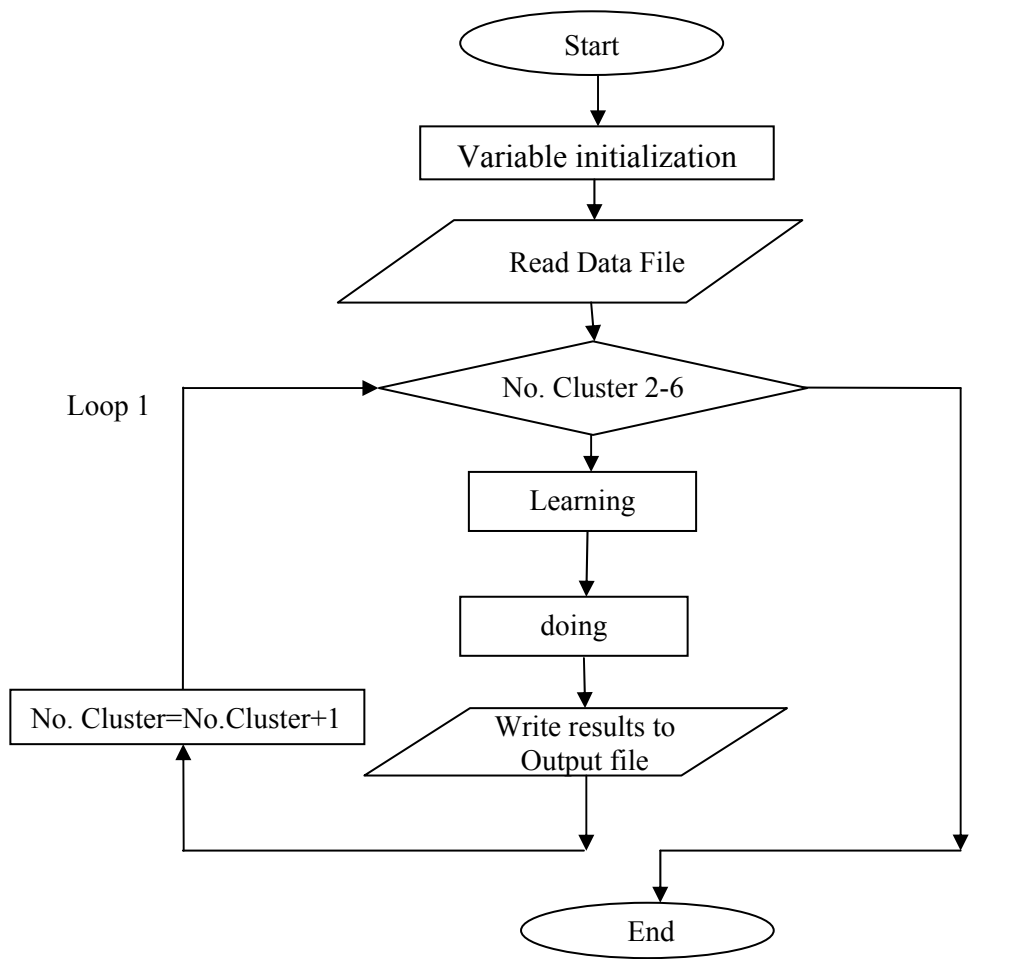
:

-: Variable initialization:

,   :

No. Data=24   (   )

.

No. Variable= 6   .

No. Cluster   .

Max.No.Cluster=6   .

...

‎:E.STOP =0.001‎ .

‎(error)‎ ‎:E.Max=0‎

.

‎:Dj‎ ‎.(Euclidean distance)‎

‎:Min Dj‎ .

‎:R=0‎ ‎,‎

‎.(2, 1, 0)‎

‎:IndexMinDj‎ ‎( )‎

.

‎:Alph=0.7‎ ‎,‎ ‎.[0, 1]‎

‎-: Read Data File‎ ‎OutP.txt‎

‎.24*6‎

‎-: Loop 1‎

‎6‎ ‎.(2)‎

‎-: Learning‎ .

‎(6)‎

‎:‎

```
                              ┌─────────┐
                              │  Start  │
                              └────┬────┘
                                   │
                         ┌─────────▼──────────┐
                         │ Initial random weight │
                         └─────────┬──────────┘
                                   │
                            ┌──────▼──────┐
                            │  E.Max =0   │
                            └──────┬──────┘
                                   │
                         ┌─────────▼─────────┐
                         │    I=NoData       │──────► ( F )
                         └─────────┬─────────┘
                                   │
                         ┌─────────▼─────────┐
                         │   Min Dj=1*10^10  │
                         └─────────┬─────────┘
                     ( E )         │
                         ┌─────────▼─────────┐
                         │  j=0 No. Cluster  │──────────┐
                         └─────────┬─────────┘          │
                                   │                    │
                              ┌────▼────┐               │
                              │  Dj=0   │               │
                              └────┬────┘               │
                                   │                    │
                         ┌─────────▼─────────┐          │
                         │  i=0 No. Variable │──┐       │
                         └─────────┬─────────┘  │       │
                   ( C )           │            │       │
                    ┌──────────────▼──────────────┐     │
                    │  Dj=Dj+(wij-Data Ii)^2       │     │
                    └──────────────┬──────────────┘     │
                                   │                    │
                              ┌────▼────┐               │
                              │  i=i+1  │               │
                              └─────────┘               │
                                                     ( D )
```

$$Min\ Dj=1*10^{10}$$

$$Dj=Dj+(wij-Data\ Ii)^{2}$$

No ◄──── /Dj/<Min Dj

Yes

(B)

Min Dj= Dj

(A)

[600]

...


```
A
B
D

IndexMinDj=j

C

j=indxMinDj-R
IndxMinDj+R

i=0   No. Variable

Wij=Wij+Alph*(DataIi-Wij)

E

i=i+1        Alph*(DataIi-Wij) >
No                E.Max
                           Yes

E.Max= Alph*(DataIi-Wij)

I=I+1                     j=j+1

                                          F

Alph=Alph*0.9

C

No        E.Max < E.STOP

                    Yes

End
```

(6):

[601]

:

: 6*6 [0, 1],

( ) ( ),

R, Alph α.

:

.

E.Max < E.STOP

E.Max: (error)

.
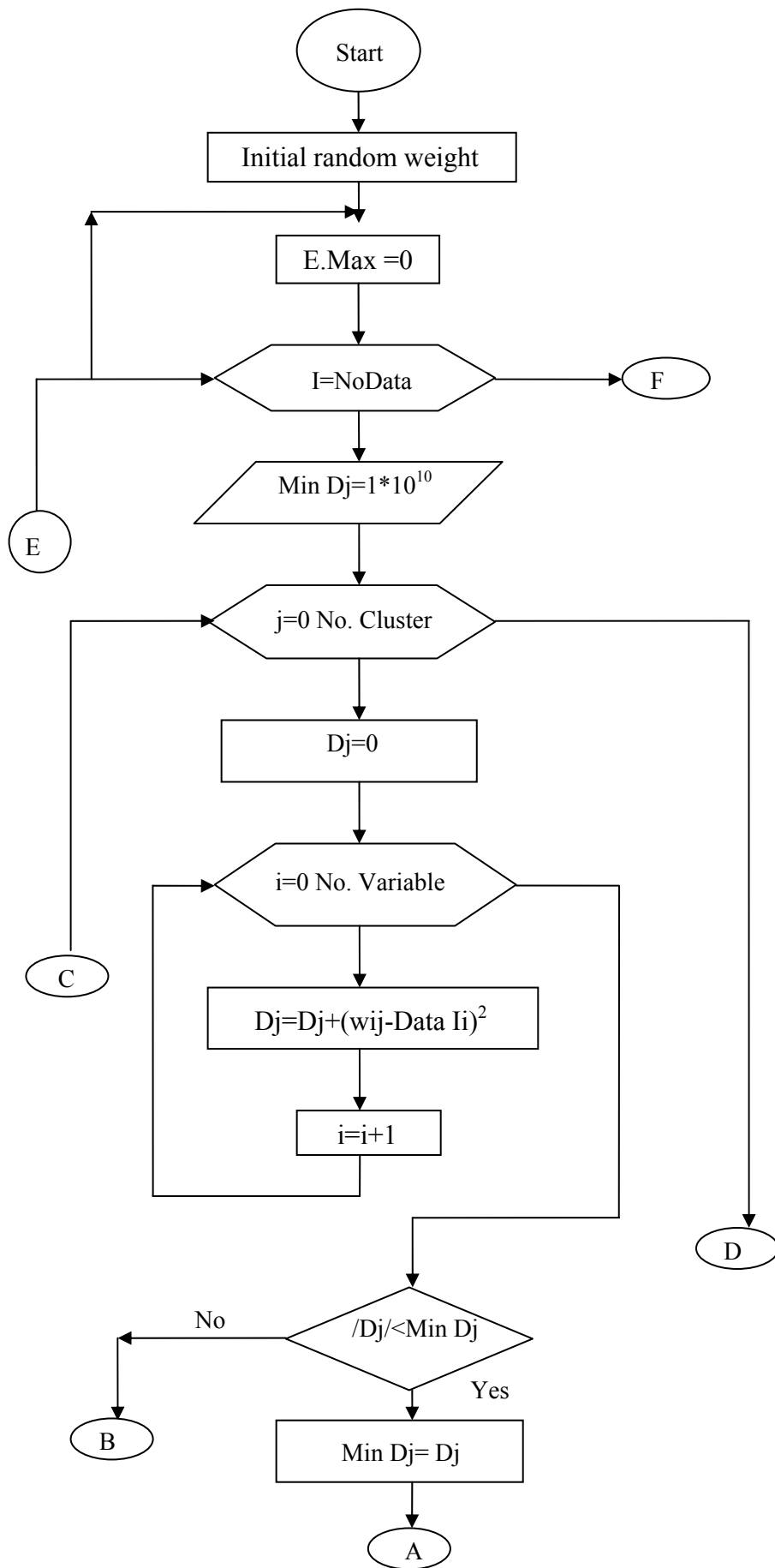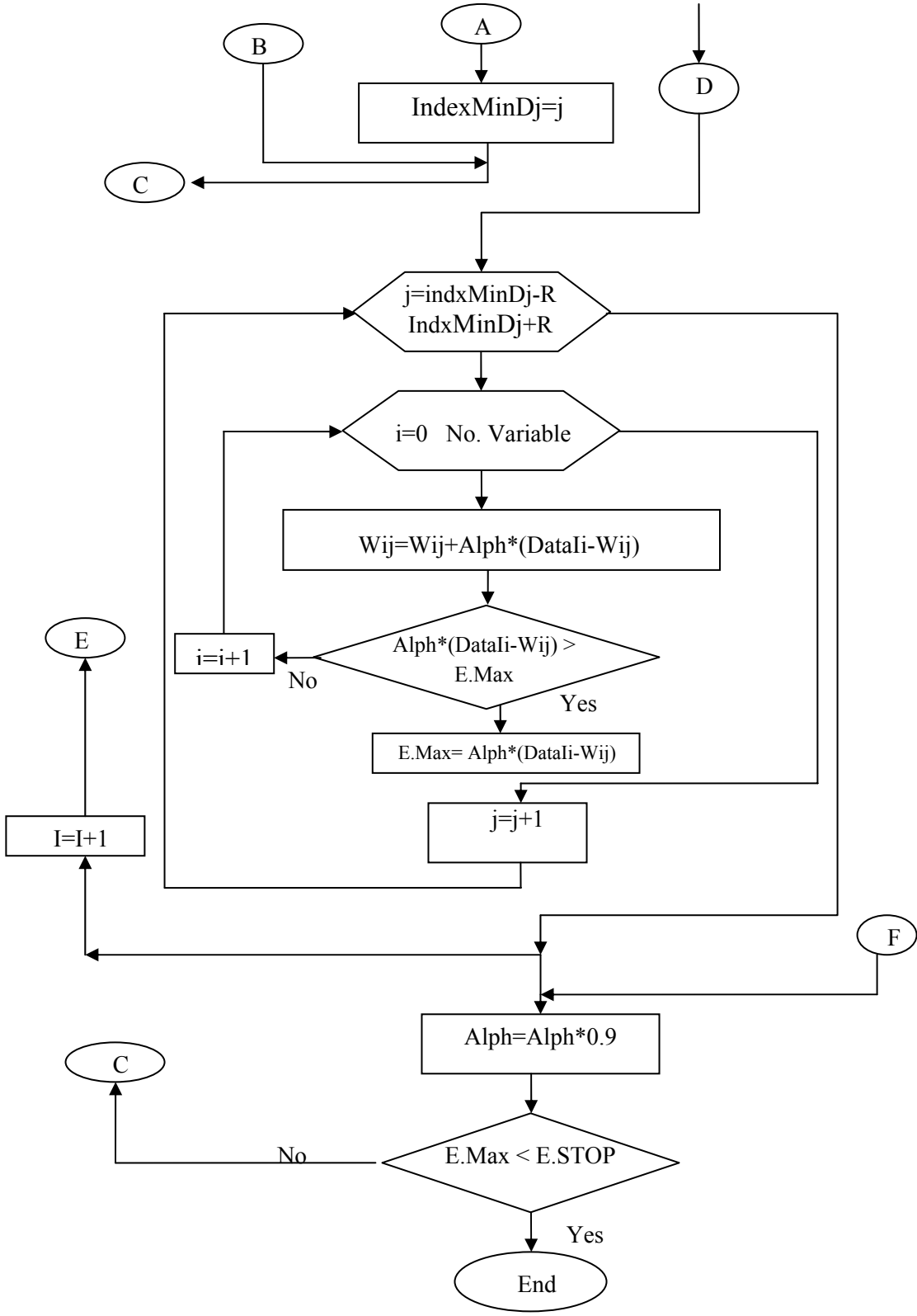
E.STOP: .

: ( )

.

: (j) :

$$D_{Ij} = [\sum (w_{ij} \_ Data_{Ii})^2]^{1/2} \qquad … (4)$$

:-

i : 6 .

j : 2 6 .

I : (1,2, ..,k) 24 .

: j Dj

IndexMinDj.

: ( ) IndexMinDj

R j, i

:

$$w_{ij} = w_{ij} + \alpha (Data_{Ii} \_ w_{ij}) \qquad … (5)$$

: .

: ( ) Alph (α) :

$$\alpha = \alpha * 0.9 \qquad … (6)$$

: R .

: .

...

doing -: .

( )

.

.Write result to output file -:

txt ,OUTP.Txt

:

-1 .

-2 No. Iteration

-3 .

-4 include ->

-5 .

-6 1 5 …. .

:

-1 txt,

,OUTP.txt :

------------------- (2 Clusters) ----------------------------------
No. of iteration = 125
C (0) {245.99 25.00 3.70 62.98 2249.74 2009.77}
 Include -> 7, (1)
C (1) {135.06 32.11 9.68 13.31 822.15 683.44}
 Include -> 1 , 2 , 3 , 4 , 5 , 6 , 8 , 9 ,10 , 11 , 12 , 13 , 14 , 15 , 16 ,17
,18 , 19 , 20 , 21 , 22 , 23 , 24 , (23)
------------------- (3 Clusters) ----------------------------------
No. of iteration = 117
C (0) { 245.99 25.00 3.70 62.98 2249.74 2009.77}
 Include -> 7, (1)
C (1) { 120.92 29.47 9.68 13.89 690.88 557.04}

Include ->1,2,3,4,5,6,8,9,10,13,15,16,17,18, 20,21,22, 24 , (18)
C (2) { 185.23   41.45   9.71   11.18   1287.28   1131.25}
 Include -> 11, 12, 14, 19, 23, (5)
-------------------- (4 Clusters) -----------------------------------
No. of iteration = 114
C (0) { 140.53   20.62   9.72   19.10   436.67   339.72}
 Include -> 1, 5, 8, 9, 15, 21, (6)
C (1) { 245.99   25.00   3.70   62.98   2249.74   2009.77}
 Include -> 7, (1)
C (2) { 185.23   41.45   9.71   11.18   1287.28   1131.25}
 Include -> 11, 12, 14, 19, 23, (5)
C (3) { 111.27   33.84   9.66   11.34   816.21   664.34}
 Include -> 2 , 3 , 4 , 6 , 10 , 13 , 16 , 17 ,18 , 20 , 22 , 24 , (12)
-------------------- (5 Clusters) -----------------------------------
No. of iteration = 114
C (0) { 0.60   0.37   0.52   0.54   0.14   0.68}
 Include -> (0)
C (1) { 245.99   25.00   3.70   62.98   2249.74   2009.77}
 Include -> 7, (1)
C (2) { 185.23   41.45   9.71   11.18   1287.28   1131.25}
 Include -> 11, 12, 14, 19, 23, (5)
C (3) { 140.53   20.62   9.72   19.10   436.67   339.72}
 Include -> 1, 5, 8, 9, 15, 21, (6)
C (4) { 111.27   33.84   9.66   11.34   816.21   664.34}
 Include -> 2 , 3 , 4 , 6 , 10 , 13 , 16 , 17 ,18 , 20 , 22 , 24 , (12)
-------------------- (6 Clusters) -----------------------------------
No. of iteration = 114
C (0) { 140.53   20.62   9.72   19.10   436.67   339.72}
 Include -> 1, 5, 8, 9, 15, 21, (6)
C (1) { 245.99   25.00   3.70   62.98   2249.74   2009.77}
 Include -> 7, (1)
C (2) { 0.12 0.93 0.16 0.14 0.81 0.08}
 Include -> (0)
C (3) { 185.23   41.45   9.71   11.18   1287.28   1131.25}
 Include -> 11, 12, 14, 19, 23, (5)
C (4) { 0.40   0.52   0.10   0.56   0.48   0.41}
 Include -> (0)
C (5) { 111.27   33.84   9.66   11.34   816.21   664.34}
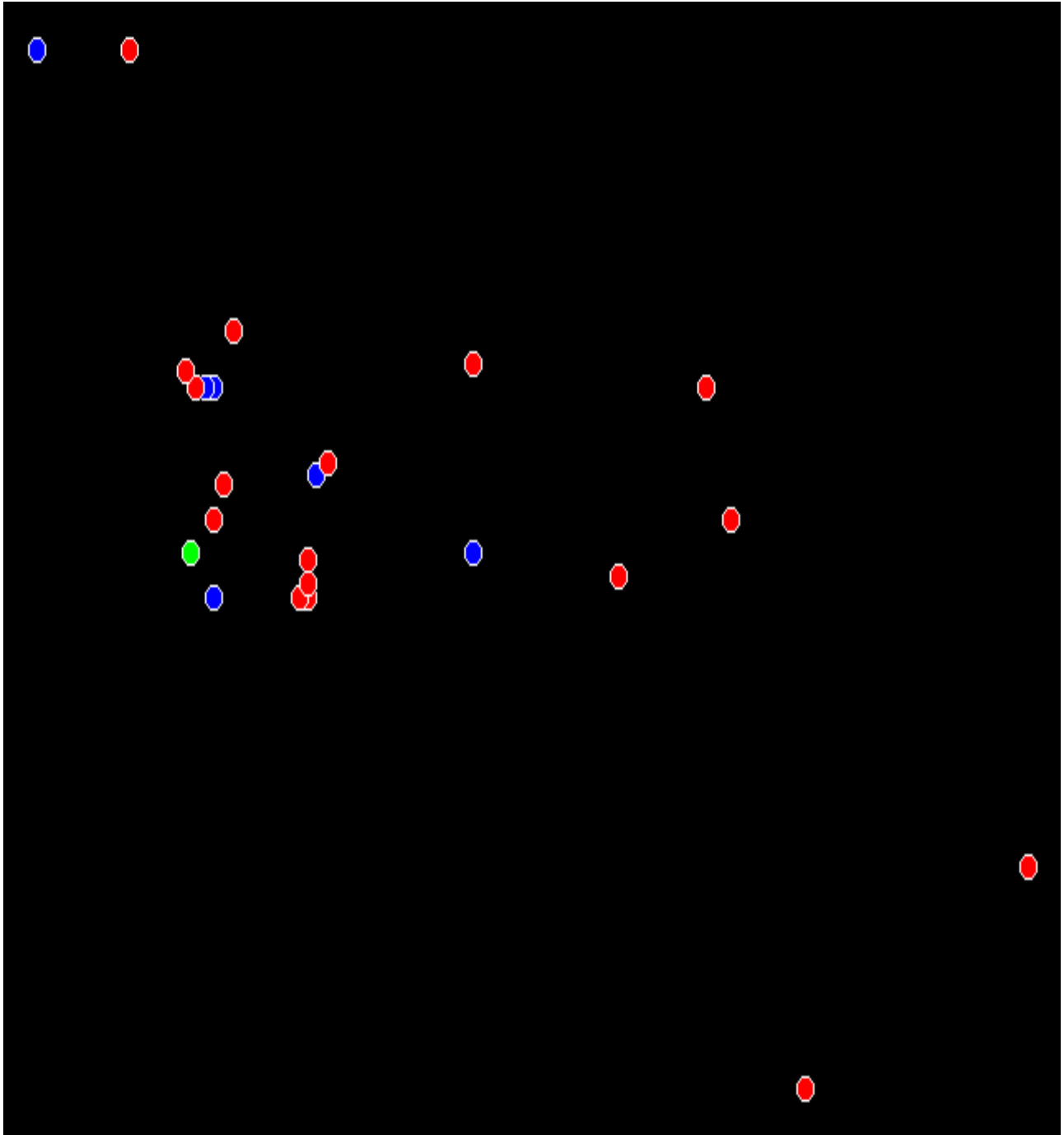 Include -> 2 , 3 , 4 , 6 , 10 , 13 , 16 , 17 ,18 , 20 , 22 , 24 , (12)

...

,   -2

,   ,

.

(2 Clusters)

(7)   ,(6 Clusters)

.   ,

: (7)

- ( )
  .(_)
- , (6)
  :

...

$=C(0)$, $=C(1)$, $=C(2)$,

$=C(3)$, $=C(4)$, $=C(5)$,

(4)

(4) ,

.

$_T.D.S$)

$E.C$ (1)

$(E.C)$,

' _____

( )

'

.

(1) :-

-1 (3)

(–) ,

(7) $C(0)$ $C(1)$,

$(E.C)$

'

.

-2)

- - (, $C(0)$

(7) $(E.C)$

, ثمانية عشر $C(1)$, (1, 2, 3, 4, 5)

24 , 22 , 21 , 20 , 18 , 17, 16 , 15 , 13 , 10 , 9 , 8 , 6)

$(E.C)$ '

$C(2)$ $(11 , 12 , 14 , 19 , 23)$

$(E.C)$

.

3-

,   )

-                                   _   _

(, $C(0)$ $(1, 5, 8, 9, 15, 21)$

$(E.C)$ $C(1)$

(7) $(E.C)$

, $C(3)$

$(11 , 12 , 14 , 19 , 23)$

, $C(5)$ $(2, 3,$

$4, 6, 10, 13, 16, 17, 18, 20, 22, 24)$ $(E.C)$

.

4-   (No. of iteration)

(122) (112)

.

5- (0.7)

, $(α)$

(0.7) .

,   :

...

.1 ,

(   )

.

.2 (2 Clusters)   (   )

.

.3   (6 Clusters)

,   (6

(Clusters

(E.C)

.

.4

(E.C)   (1, 5, 8, 9, 15, 21)   (, 6 ,4 ,3 ,2

(10, 13, 16, 17, 18, 20, 22, 24

,   (11, 12, 14, 19, 23)

,   (7)

.

.5   (1, 5, 8, 9, 15, 21)

,

(7)   .

.6   (   )   (7)

.

.7   (Global Mapper v.11)   (C++ v. 3)

,

,(   )

.(Global Mapper V.11)

8.   ,

,

,

.

:

(   )

.

1-   ,(1999), "

",

.

2-   (2002) "

"

3-   ,   ,(2000), "   ,"

,   ,   .

4-   ,   ,(2010), "

,"

,   ,   ,

.   ,

5-   (2000), "

"

.

...

"   " (2001)   6-

.

" ,(2000) ,   7-
"

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