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.   (,   )

)   .

,   (

(Back probagation)   (perceptron)

.

Arabic letters recognition based on BP and perceptron and compare the performance of them
Abstract

In this research we used a new method to distinguish the Arabic letter, depending on the different sizes of the Arabic letter and apply to all Arabic letters similar and dissimilar and took the character movements (opening, Vibrio, and Kasra) and will reach a good results.

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proposed algorithm working begin by introduce the Arabic letters, and a preliminary treatment in the image of the Arabic letters .in this research will be studied (matrix of a co-occurrences and characteristics of the matrix) as a parameter to distinguish the Arabic letter and give strong rate of recognition, applying network (perceptron) and a network (Back probagation) in order to speed up the process of recognition   and   make comparison between   performance of the two networks.

-1

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.

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.[5]

.[3]

[Ibrahim,2002]

[,2001]   .

(word 1997)

,2003]   .

.   [

[,2004]

.

-2

Properties Of

Perceptron   Gray_levelco_occurrence Matrix

.   Back prgbagation

-3   -:

(on-line)   ,

(off-line)

,

.

,   :

-1   29   +, , , , , , , ,=36   ,   16

.

-2   (   )   :   +   +

+   +   +   +

.

-3   (   )   ( ),

:   ,   ,

-              .

-              .

-              .

-              [6].

-4   Co-occurrence Matrices:-

haralick   1973,

(   ),(

,

[732]

...

(P) (accumulator) (P[i,j])

(i) (j)

(d=(dx,dy)), (dx)

(x-axis). (dy) (y-axis),

[7][10]:-

4-1 **Energy**:-

(pixels pair), (1)

:-

$$Energy = \sum \sum p^2[i,j] \cdots \cdots \qquad (1)$$

4-2 **Contrast**:-

، (2)

:

$$Contrast = (i-j)^2 p[i,j] \qquad \cdots \cdots \qquad (2)$$

(1)

.

X: تمثل الحروف العربية من ألاف إلى الياء

Y:تمثل نتيجة تطبيق صفة التجانس على جميع الحروف

(1) :

3-4 **Homogeneity:**

',   (3)

:

$$y \;=\; \sum\; \sum\; \frac{p\,[\,i\,,\,j\,]}{1\,-\,\left|\,i\,-\,j\,\right|}\dots\dots \qquad (3)$$

(3)

(2).

x: تمثل الحروف العربية من الف الى الياء

Y:تمثل نتيجة تطبيق صفة التجانس على جميع الحروف

(2):

4-4 **correlation :-**

'

'

(4)   :

$$Correlatio\,n \;=\; \sum \sum \frac{i-\mu(\,j-\mu)\,p\,[i,\,j]}{\delta} \qquad \dots\dots \qquad (4)$$

5– :

.(3)

إجراء عملية معالجة أولية للحرف

تطبيق عملية حدوث المشاركة على الصورة
وحساب الصفات

شبكة back

شبكة Perceptron

مقارنة ما بين شبكة Perceptronوشبكة back propagation

عرض الحرف ونطقه

عرض صورة الحرف

(3)

: -

1– : preprocessing:-

,
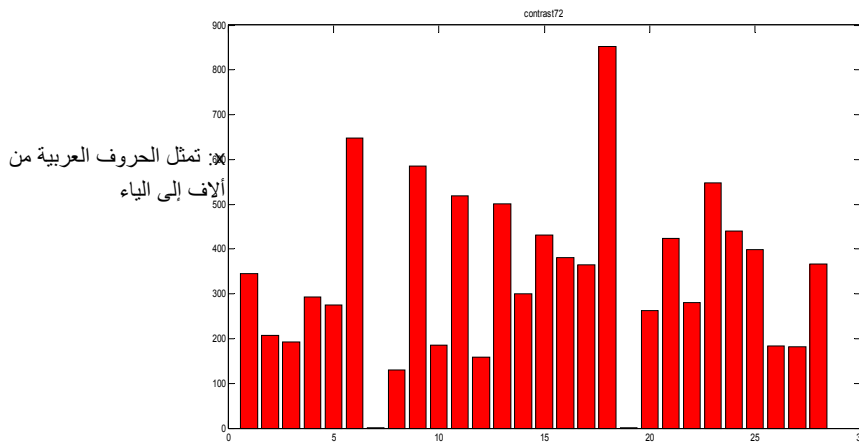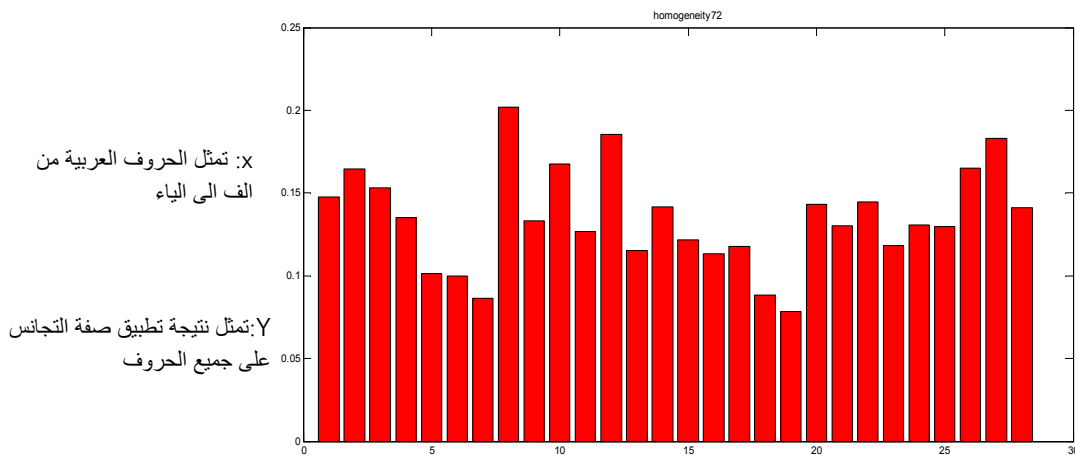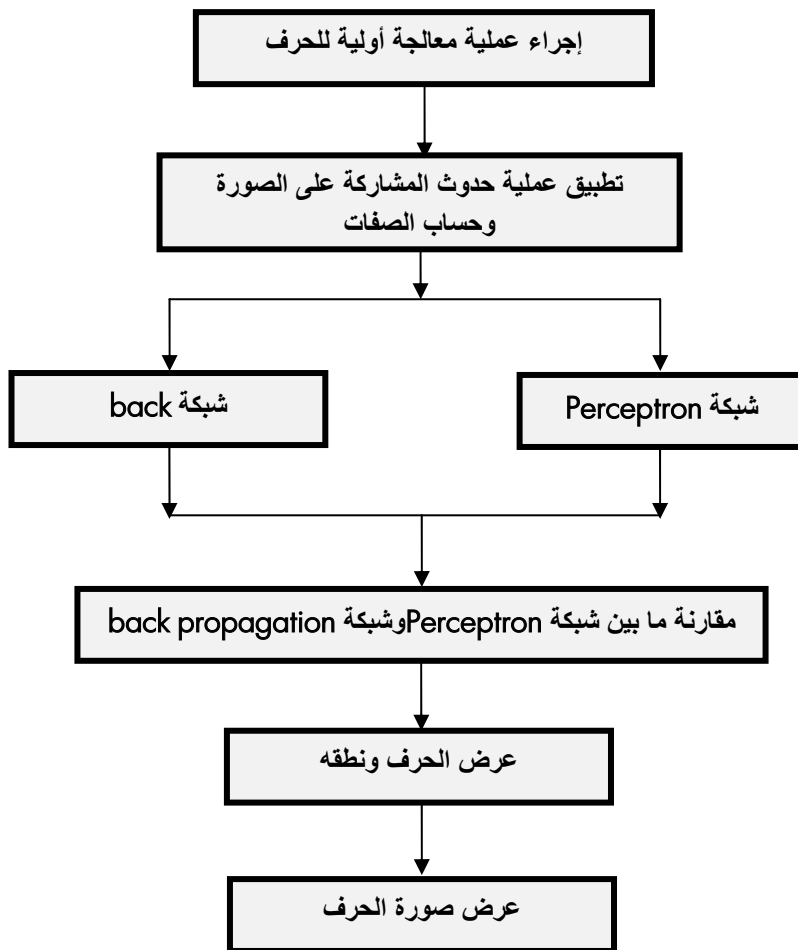
,(Editors)

.

.

:

Gray   Image   Paint   .

.   Simplified Arabic

(Truncation Operation)   .

.

.(4)

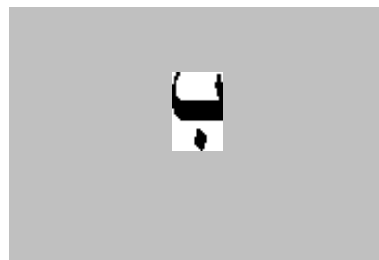( )   (4-a)

( )   (4-b)

( )   (4-c)

(4-d)

...

(4)

<div dir="rtl">

-2   :

.

:( )

</div>

Contrast :207.7400
Correlation:0.0322
Energy:0.0016
Homogeneity:0.1647

<div dir="rtl">

-3   :

Binary   :( )

</div>

Contrast:'01001101'
Correlation:'00110100'
Energy:'00101011'
Homogeneity:'00111000'
Fa = [0 1 0 0 1 1 0 1 0 0 1 1 0 1 0 0 0 0 1 0 1 0 1 1 0 0 1 1 1 0 0 0];

<div dir="rtl">

-4   :

(perceptron   Back   probagation   )

:

-                    Perceptron:

Perceptron   Binary
[2],   Binary
(w_{ij})   goal   net   (5):

</div>

$$net = (\sum x_{ij} * w_{ij}) - goal \qquad \cdots\cdots \quad (5)$$

<div dir="rtl">

net   goal   net
goal   net   goal

</div>

'

(w$_{ij}$)   (6):

$$w_{ij} = w_{ij} + cc*1*(goal-net) \qquad \cdots\cdots \qquad (6)$$

net   net   goal

.

(error)

( )   Net=1.6000   Goal=2.

Error=Goal-Net=2-1.6000=0.4000

-                    Back probagation:

(Bp)

Binary   '

'   Binary   (Bp)

(w$_{ij}$)   goal   net.

.   [8]:

$$a1 = \tan sig(IW_{1,1}p_1 + b_1) \qquad \cdots\cdots \qquad (7)$$

.   [8]:-

$$a1 = purelin(LW_{2,1}a_1 + b_2) \qquad \cdots\cdots \qquad (8)$$

net   net

goal   .

(error)

( )   Net=1.80   Goal=2

Error=Goal - Net=2-1.80=0.20

'

[738]

...

6- : -

(5) :

```
                    ┌─────────────┐
                    │    بداية    │
                    └─────────────┘
                           │
                           ▼
                    ╱──────────────╲
                   ╱   إدخال حرف    ╲
                   ╲                ╱
                    ╲──────────────╱
                           │
                           ▼
                ┌──────────────────────┐
                │ إجراء عملية التقطيع   │
                │      للحرف            │
                └──────────────────────┘
                           │
                           ▼
                ┌──────────────────────────┐
                │ تطبيق عملية حدوث المشاركة │
                │ على الصورة وحساب الصفات   │
                └──────────────────────────┘
                           │
                           ▼
                ┌──────────────────────┐
                │ تحويل قيم الصفات      │
                │    إلىbinary         │
                └──────────────────────┘
                           │
                           ▼
  ┌──────────────────┐    ╱──────────────╲
  │ إدخال قيم الصفات  │◄──╱ تحديد الشبكة   ╲
  │ إلى شبكه          │   ╲  المطلوبة      ╱
  │ Perceptron        │    ╲──────────────╱
  └──────────────────┘           │
          │                      ▼
          │           ┌──────────────────────┐
          │           │ إدخال قيم الصفات إلى  │
          │           │     شبكةBP           │
          │           └──────────────────────┘
          │                      │
          └──────────────────────┤         ┌──────────────┐
                                  │         │  تغيير الوزن │
                                  ▼         └──────────────┘
                            ╱──────────╲    لا      ▲
                           ╱ net~=goal  ╲──────────┘
                           ╲            ╱
                            ╲──────────╱
                               │ نعم
                               ▼
                        ┌──────────────┐
                        │   Net=goal   │
                        └──────────────┘
                               │
                               ▼
                        ┌──────────────┐
                        │ عرض نطق الحرف │
                        └──────────────┘
                               │
                               ▼
                        ┌──────────────┐
                        │ عرض صورة الحرف│
                        └──────────────┘
                               │
                               ▼
                        ┌──────────────┐
                        │    نهاية     │
                        └──────────────┘
```

(5):

[739]

: **7–**

(1)
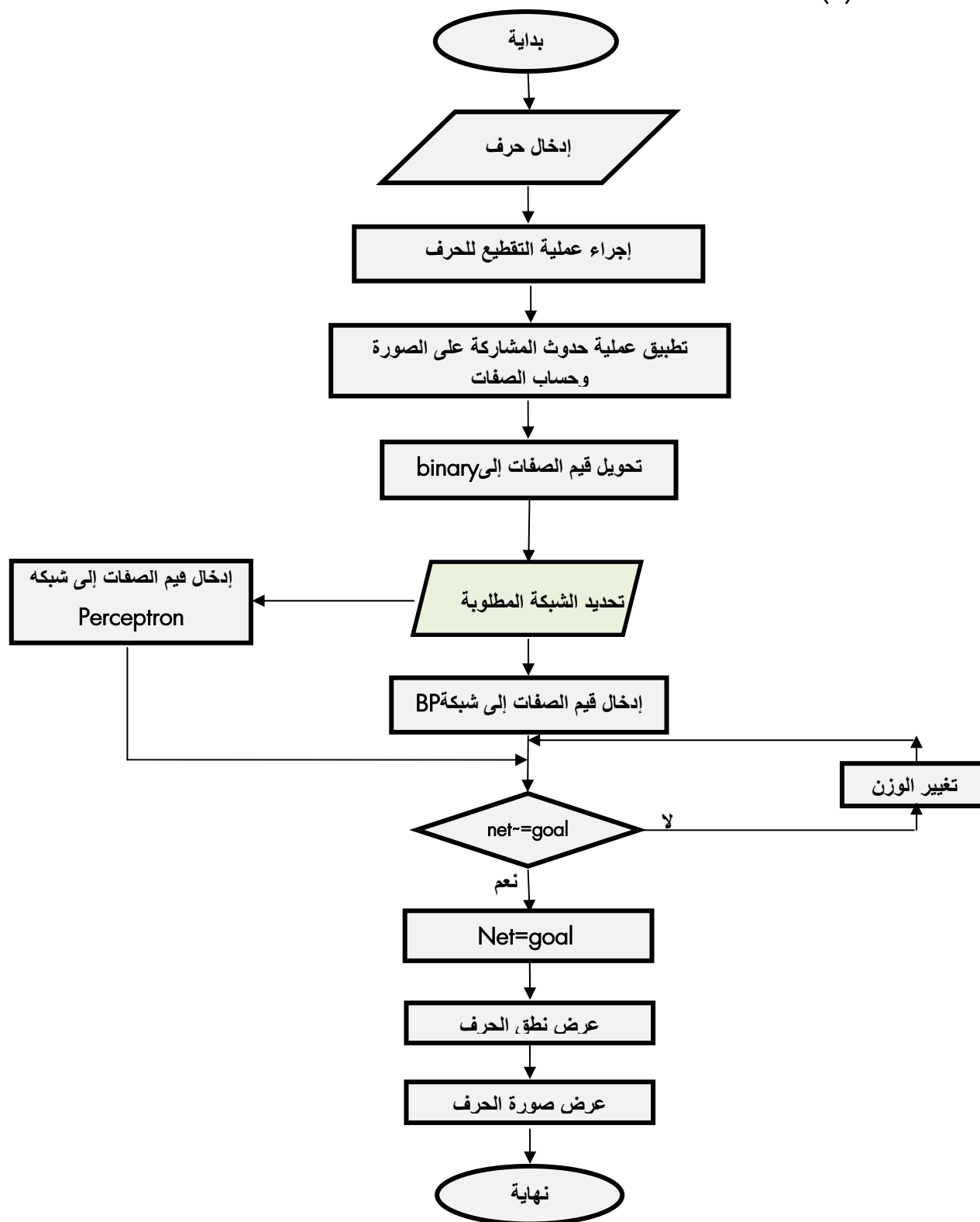
perceptron .

				binary			
	(perceptron)					:(1)	
		error	goal	net	binary		
الف	7.6775	0.0055	1	0.9945	Contrast:'01001110'Correlation:'00110101'Energy:'00110010'Homogeneity:'00111000'	Contrast:345.3607Correlation:0.049Energy:0.0164Homogeneity:0.1476	.1
باء	2.2084	0.4000	2	1.6000	Contrast:'01001101'Correlation:'00110100'Energy:'00101011'Homogeneity:'00111000'	Contrast:207.7400Correlation:0.0322Energy:0.0016Homogeneity:0.1647	.2
با	2.2598	0.0000	3	3.0000	Contrast:'01010000'Correlation:'00110000'Energy:'00101001'Homogeneity:'00110111'	Contrast:691.1843Correlation:0.0092Energy:8.1900e-004Homogeneity:0.1051	.3
بي	3.0032	0.2952	4	3.7048	Contrast:'01001111'Correlation:'00110101'Energy:'00101001'Homogeneity:'00110111'	Contrast:482.9182Correlation:0.0578Energy:9.3985e-004Homogeneity:0.1245	.4
بو	7.5853	0.7942	5	4.2058	Contrast:'01010001Correlation:'00110000'Energy:'00101000'Homogeneity:'00110111	Contrast:945.8093Correlation:0.0098Energy:7.1174e-004Homogeneity:0.0963	.5
تاء	1.7158	0.0480	6	5.9520	Contrast:'01001101'Correlation:'10110101'Energy:'00101011'Homogeneity:'00111000'	Contrast:193.5822Correlation:-0.0350Energy:0.0017Homogeneity:0.1529	.6
ثاء	9.2483	0.4872	7	6.5128	Contrast:'01001110'Correlation:'10110000'Energy:'00101010'Homogeneity:'00111000'	Contrast:293.5775Correlation:-0.0070Energy:0.0013Homogeneity:0.1353	.7

740

جيم	2.2963	0.0332	8	7.9668	Contrast: '01010000'Correlation:'00110100'Energy:'00101010'Homogeneity:'00110111'	Contrast: 676.0700Correlation:0.0330Energy:0.0015Homogeneity:0.1015	.8
حاء	5.2362	0.0111	9	8.9889	Contrast: '01010000'Correlation:'00110010'Energy:'00101010'Homogeneity:'00110111'	Contrast: 648.8725Correlation:0.0190Energy:0.0014Homogeneity:0.0999	.9
خاء	2.6475	0.3701	10	9.6299	Contrast: '01010010'Correlation:'10110100'Energy:'00101010'Homogeneity:'00110110'	Contrast:1.1616e+003Correlation:0.0263Energy:9.8135e-004Homogeneity:0.0864	.10
دال	1.3178	0.1635	11	10.8365	Contrast: '01001011'Correlation:'10110110'Energy:'00101110'Homogeneity:'00111001'	Contrast: 127.6936Correlation:-0.0576Energy:0.0058Homogeneity:0.2088	.11
ذال	2.3459	0.4482	12	11.5518	Contrast: '01010000'Correlation:'10110101'Energy:'00101100'Homogeneity:'00111000'	Contrast: 586.0488Correlation:-0.0447Energy:0.0024Homogeneity:0.1333	.12
راي	1.7859	0.3887	13	12.6113	Contrast: '01001100'Correlation:'10110100'Energy:'00101100'Homogeneity:'00111000'	Contrast: 185.1804Correlation:-0.0258Energy:0.0022Homogeneity:0.1676	.13
زاي	0.6139	0.1797	14	13.8203	Contrast: '01010000'Correlation:'10110011'Energy:'00101010'Homogeneity:'00111000'	Contrast: 519.1744Correlation:-0.0171Energy:0.0014Homogeneity:0.1265	.14
سين	2.1217	0.0333	15	14.9667	Contrast: '01001100'Correlation:'00111010'Energy:'00101010'Homogeneity:'00111001'	Contrast: 160.3923Correlation:0.2753Energy:0.0012Homogeneity:0.1938	.15
شين	5.1572	0.3361	16	15.6639	Contrast: '01001111'Correlation:'10101110'Energy:'00101000'Homogeneity:'00110111'	Contrast: 501.0537Correlation:-0.0039Energy:6.3898e-004Homogeneity:0.1155	.16
صاد	2.8334	0.4061	17	16.5939	Contrast: '01001110'Correlation:'00110110'Energy:'00101001'Homogeneity:'00111000'	Contrast: 275.8855Correlation:0.0636Energy:9.2336e-004Homogeneity:0.1555	.17

ضاد	3.2536	0.4082	18	17.5918	Contrast:'01001111'Correlation:'10101011'Energy:'00101000'Homogeneity:'00110111'	Contrast: 432.0436Correlation:-9.9546e-004Energy:6.0569e-004Homogeneity:0.1220		.18
طاء	1.7847	0.0442	19	18.9558	Contrast:'01001110'Correlation:'00110001'Energy:'00101011'Homogeneity:'00110111'	Contrast: 382.4710Correlation: 0.0120Energy: 0.0017Homogeneity: 0.1121		.19
ظاء	7.1074	0.0585	20	19.9415	Contrast:'01001110'Correlation:'10101100'Energy:'00101011'Homogeneity:'00110111'	Contrast: 380.9904Correlation: -0.0016Energy: 0.0019Homogeneity: 0.1154		.20
عين	4.8871	0.5618	21	20.4382	Contrast:'01010001'Correlation:'10110010'Energy:'00101010'Homogeneity:'00110110'	Contrast: 836.7977Correlation: -0.0118Energy: 0.0014Homogeneity: 0.0893		.21
غين	0.5503	0.2868	22	21.7132	Contrast:'01010010'Correlation:'00110001'Energy:'00101001'Homogeneity:'00110110'	Contrast: 1.4465e+003Correlation: 0.0121Energy:9.3197e-004Homogeneity: 0.0780		.22
فاء	1.8342	0.3277	23	22.6723	Contrast:'01001110'Correlation:'10110010'Energy:'00101010'Homogeneity:'00111000'	Contrast: 262.0269Correlation: -0.0145Energy: 0.0011Homogeneity:0.1432		.23
قاف	8.5525	0.2106	24	23.7894	Contrast:'01001111'Correlation:'00110100'Energy:'00101010'Homogeneity:'00111000'	Contrast: 424.0940Correlation: 0.0389Energy: 0.0011Homogeneity:0.1304		.24
كاف	4.8811	0.0283	25	24.9717	Contrast:'01001110'Correlation:'00110000'Energy:'00101011'Homogeneity:'00111000'	Contrast: 264.2187Correlation: 0.0094Energy: 0.0019Homogeneity:0.1460		.25
لام	1.9552	0.3838	26	25.6162	Contrast:'01010000'Correlation:'10110001'Energy:'00101010'Homogeneity:'00110111'	Contrast: 562.6315Correlation: -0.0086Energy: 0.0014Homogeneity:0.1153		.26
ميم	3.8251	0.3595	27	26.6405	Contrast:'01001111'Correlation : '00110101'Energy : '00101101'Homogeneity : '00111000'	Contrast: 440.7681Correlation: 0.0481Energy: 0.0030Homogeneity:0.1308		.27

نون	1.6917	0.3784	28	27.6216	Contrast: '01001111'Correlation:'0011 0000'Energy:'00101010'H omogeneity:'00111000'	Contrast: 398.0652Correlation: 0.0103Energy: 0.0014Homogeneity:0.1298		.28
هاء	14.2110	0.8238	29	28.1762	Contrast: '01001101'Correlation:'1011 0101'Energy:'00101011'Ho mogeneity:'00111000'	Contrast: 193.6564Correlation: - 0.0440Energy: 0.0019Homogeneity:0.1588		.29
واو	4.6911	0.1834	30	29.8166	Contrast: '01001100'Correlation:'001 10101'Energy:'00101100'Ho mogeneity:'00111000'	Contrast: 167.6791Correlation: 0.0536Energy: 0.0022Homogeneity:0.1835		.30
ياء	4.7053	0.9705	31	30.0295	Contrast: '01001110'Correlation:'1011 0000'Energy:'00101011'Ho mogeneity:'00111000'	Contrast: 366.7694Correlation: - 0.0066Energy: 0.0017Homogeneity:0.1413		.31

Back probagation

.

		error	goal	net	binary			
الف	0.3120	0.011	1	0.989	Contrast:'01001110'Correlation:'00110101'Energy:'00110010'Homogeneity:'00111000'	Contrast: 345.3607Correlation:0.049Energy: 0.0164Homogeneity: 0.1476		.1
باء	0.2960	0.2	2	1.80	Contrast:'01001101'Correlation:'00110100'Energy:'00101011'Homogeneity:'00111000'	Contrast: 207.7400Correlation:0.0322Energy:0.0016Homogeneity:0.1647		.2
با	0.4210	0.19	3	2.81	Contrast:'01010000'Correlation:'00110000'Energy:'00101001'Homogeneity:'00110111'	Contrast: 691.1843Correlation:0.0092Energy:8.1900e-004Homogeneity:0.1051	بَ	.3
بي	0.2800	0.34	4	3.66	Contrast:'01001111'Correlation:'00110101'Energy:'00101001'Homogeneity:'00110111'	Contrast: 482.9182Correlation:0.0578Energy:9.3985e-004Homogeneity:0.1245	بِ	.4
بو	0.3120	0.43	5	4.57	Contrast:'01010001Correlation:'00110000'Energy:'00101000'Homogeneity:'00110111	Contrast: 945.8093Correlation:0.0098Energy:7.1174e-004Homogeneity:0.0963		.5
تاء	0.2800	0.66	6	5.34	Contrast:'01001101'Correlation:'10110101'Energy:'00101011'Homogeneity:'00111000'	Contrast: 193.5822Correlation:-0.0350Energy:0.0017Homogeneity:0.1529		.6
ثاء	0.2970	0.49	7	6.51	Contrast:'01001110'Correlation:'10110000'Energy:'00101010'Homogeneity:'00111000'	Contrast: 293.5775Correlation:-0.0070Energy:0.0013Homogeneity:0.1353		.7

Table header: Backprbagation (2)

جيم	0.29 70	0.68	8	7.32	Contrast:'01010000'Correlation:'00110100'Energy:'00101010'Homogeneity:'00110111'	Contrast: 676.0700Correlation:0.0330Energy:0.0015Homogeneity:0.1015		8.
حاء	0.29 90	0.52	9	8.48	Contrast:'01010000'Correlation:'00110010'Energy:'00101010'Homogeneity:'00110111'	Contrast: 648.8725Correlation:0.0190Energy:0.0014Homogeneity:0.0999		9.
خاء	0.40 60	0.4	10	9.60	Contrast:'01010010'Correlation:'10110100'Energy:'00101010'Homogeneity:'00110110'	Contrast:1.1616e+003Correlation:0.0263Energy:9.8135e-004Homogeneity:0.0864		10.
دال	0.40 60	0.6	11	10.4	Contrast:'01001011'Correlation:'10110110'Energy:'00101110'Homogeneity:'00111001'	Contrast: 127.6936Correlation:-0.0576Energy:0.0058Homogeneity:0.2088		11.
ذال	0.40 60	0.1	12	11.9	Contrast:'01010000'Correlation:'10110101'Energy:'00101100'Homogeneity:'00111000'	Contrast: 586.0488Correlation:-0.0447Energy:0.0024Homogeneity:0.1333		12.
راي	0.40 60	0.8	13	12.2	Contrast:'01001100'Correlation:'10110100'Energy:'00101100'Homogeneity:'00111000'	Contrast: 185.1804Correlation:-0.0258Energy:0.0022Homogeneity:0.1676		13.
زاي	0.34 30	0.7	14	13.3	Contrast:'01010000'Correlation:'10110011'Energy:'00101010'Homogeneity:'00111000'	Contrast: 519.1744Correlation:-0.0171Energy:0.0014Homogeneity:0.1265		14.
سين	0.312 0	0.6	15	14.4	Contrast:'01001100'Correlation:'00111010'Energy:'00101010'Homogeneity:'00111001'	Contrast: 160.3923Correlation:0.2753Energy:0.0012Homogeneity:0.1938		15.
شين	0.312 0	0.6	16	15.4	Contrast:'01001111'Correlation:'10101110'Energy:'00101000'Homogeneity:'00110111'	Contrast: 501.0537Correlation:-0.0039Energy:6.3898e-004Homogeneity:0.1155		16.
صاد	0.29 60	0.6	17	16.4	Contrast:'01001110'Correlation:'00110110'Energy:'00101001'Homogeneity:'00111000'	Contrast: 275.8855Correlation:0.0636Energy:9.2336e-004Homogeneity:0.1555		17.

ضاد	0.2810	0.9	18	17.1	Contrast:'01001111'Correlation:'10101011'Energy:'00101000'Homogeneity:'00110111'	Contrast:432.0436Correlation:-9.9546e-004Energy:6.0569e-004Homogeneity:0.1220		.18
طاء	0.4060	0.7	19	18.3	Contrast:'01001110'Correlation:'00110001'Energy:'00101011'Homogeneity:'00110111'	Contrast:382.4710Correlation:0.0120Energy:0.0017Homogeneity:0.1121		.19
ظاء	0.2810	1	20	19.0	Contrast:'01001110'Correlation:'10101100'Energy:'00101011'Homogeneity:'00110111'	Contrast:380.9904Correlation:-0.0016Energy:0.0019Homogeneity:0.1154		20.
عين	0.2810	0.7	21	20.3	Contrast:'01010001'Correlation:'10110010'Energy:'00101010'Homogeneity:'00110110'	Contrast:836.7977Correlation:-0.0118Energy:0.0014Homogeneity:0.0893		.21
غين	0.2810	0.2	22	21.8	Contrast:'01010010'Correlation:'00110001'Energy:'00101001'Homogeneity:'00110110'	Contrast:1.4465e+003Correlation:0.0121Energy:9.3197e-004Homogeneity:0.0780		22.
فاء	0.2810	0.2	23	22.8	Contrast:'01001110'Correlation:'10110010'Energy:'00101010'Homogeneity:'00111000'	Contrast:262.0269Correlation:-0.0145Energy:0.0011Homogeneity:0.1432		23.
قاف	0.3430	0.7	24	23.3	Contrast:'01001111'Correlation:'00110100'Energy:'00101010'Homogeneity:'00111000'	Contrast:424.0940Correlation:0.0389Energy:0.0011Homogeneity:0.1304		24.
كاف	0.2970	0.2	25	24.8	Contrast:'01001110'Correlation:'00110000'Energy:'00101011'Homogeneity:'00111000'	Contrast:264.2187Correlation:0.0094Energy:0.0019Homogeneity:0.1460		25.
لام	0.2970	0.9	26	25.1	Contrast:'01010000'Correlation:'10110001'Energy:'00101010'Homogeneity:'00110111'	Contrast:562.6315Correlation:-0.0086Energy:0.0014Homogeneity:0.1153		26.

ميم	0.2970	0.2	27	26.8	Contrast:'01001111'Correlation :'00110101'Energy :'00101101'Homogeneity :'00111000'	Contrast: 440.7681Correlation: 0.0481Energy: 0.0030Homogeneity:0.1308		27.
نون	0.2970	0.8	28	27.2	Contrast:'01001111'Correlation:'00110000'Energy:'00101010'Homogeneity:'00111000'	Contrast: 398.0652Correlation: 0.0103Energy: 0.0014Homogeneity:0.1298		28.
هاء	0.2970	0.4	29	28.6	Contrast:'01001101'Correlation:'10110101'Energy:'00101011'Homogeneity:'00111000'	Contrast: 193.6564Correlation: -0.0440Energy: 0.0019Homogeneity:0.1588		29.
واو	0.2970	0.4	30	29.6	Contrast:'01001100'Correlation:'00110101'Energy:'00101100'Homogeneity:'00111000'	Contrast: 167.6791Correlation: 0.0536Energy: 0.0022Homogeneity:0.1835		30.
ياء	0.3120	0.7	31	30.3	Contrast:'01001110'Correlation:'10110000'Energy:'00101011'Homogeneity:'00111000'	Contrast: 366.7694Correlation: -0.0066Energy: 0.0017Homogeneity:0.1413		.31

8– :

(1) perceptron

( ) 7.6775 (2)

Bp ( ) 0.312

Bp

perceptron Bp

perceptron .

(1) perceptron

net ( ) 0.9945 (goal)=1

net

(2) Bp net ( ) 0.989

(goal) =1 ( )

(goal)   net

Bp   perceptron

$8=$ $net = 7.32$ ( )

8                    $net = 7.9668$ perceptron

Bp   perceptron

.   Bp

perceptron

9–   **:**

–:

.1

.2

.(1,2)

.3

.4

10–   :

.1   (2001) "   word

(7)"   ,   ,   .

.2   , (2005) "   "

.

.3   .   , (1999) "   ,"   .

.4   ,   , (2003) "

"   ,   ,   ,   .

.5   .   , (1996) "   ,"

,   .

.6   , (2004) "   "

,   ,   ,   .

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