

- also known as kohonen Feature maps or topology-preserving maps.

- competition based new paradigm for data clustering.
- NIW of this type impose a neighborhood constraint on the old units, such that a certain topological property in the ild data is reflected in the old units weights.
 - Similar to competative learning n/w.
 - For Kohonen Feature maps, we update not only the winning unit's weights but also all of the weights in a neighborhood around the winning units. The neighborhous size decreases slowly with each iteration.

step1: select the winning of punit as the one with the largest similarity measure

(or smallest disimilarity measure) beth all weight vectors will be the ilprovector x.

dissimilarity measure, then the winning unit a gatisfies the following eqn.

|| x - well = min || x - will,

where the index c refers to the winning unit

	Page Date	
Stepa	Let NBc denote a set of index!	
P2 54 9	corresponding to a neighborhood around	
	winner chara privilege a constant	
in Linear	The weights of the winner & its	
121-111	neighboring units are then updated by	
	$\Delta w_i = \eta (x - w_i)$, if NBC	
Linds	radpien a example supplied to pin	
C 10	where n => small positive learning	
711	de ai plingora rate o pari do la	
	elding all and the last of the	
	Neighborhood funn 12c(i) arround winning	
100 m	unit C.	
	(agussian function)	
4071 0 1	100 Con (0-11pi -pc112)	
nelp fil	$\frac{1}{2} \left(\frac{1}{2} \right) = \exp \left(\frac{-1}{2} \right) = \exp \left(\frac{-1}{2} \right)$	
100	drowing of the uneights in a neighborh	
Market idel	where pi & Pc > positions of the O/p.	
mail	vall area all assignmentanits virte Carle	
	0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
9/1/	scope of neighborhood.	
in City	manager of inclination book and front from sundated	
ALL THAT	By using neighborhood function, updated	
-6	$\Delta = n - 2(i)(x - wi)$	
i primi	ula itarada, morranista inizzik	
	where i = index for all ofp units	
	Missis x Il rusi = llou - x II	
	i i	
Mar par .	product sales a valuation to the term	

	Page
	Kohonen's Self Organizing maps.
Steps	Action to a minute of the second of the seco
Initialise weights, set max value for	
gains x	set learning rate a.
2.	while stopping condition false do steps 3 tog
2	For each i/p vector x do step & to 8.
3.	For each 1/p vector x do step & to g
4.	For each j neuron, compute the Euclidean
Shari at	9 distance De De Brisse
avetton	$D(j) = \left(\frac{\sum_{i=1}^{n} (x_i - \omega_{ij})^2}{\sum_{i=1}^{n} (x_i - \omega_{ij})^2} \right)$
	$D(j) = \sqrt{\frac{2}{2}(x_i - \omega_{ij})}$
gile G	
5.	Find the index J such that D(J) is min
	l'a constitue de la constitue
6.	For all neurons j within a specified
	neighbourhood of J & for all i
	ω; (new) = w; (old) + α(x; - w; (old))
7.	update learning rate X. It is a decreasing
	Punction of the no of epochs.
8.	Reduce radius of topological neighbourhood
	at specified times.
0	tack atanaina condition, traincelly this is
9.	a small value of the learning rate with which, the weight updates are
	with which the weight updates are
	insignificant.
	7.701917

	105	0 80.07
		Page Dare
1/30(0)		
(37.	w _{II}	initial weight
	(V) Was Was	matrix.
	W22	
	(Y ₃) (Y ₂)	w_{11} w_{12}
	101 113 (114)	w_{21} w_{22}
1-0-1	(xy)	w31 w32
- 6	42	W41 W42
(00-1)	(f(25-2-0)) 1 (0-0-0) 4 - 101	
rons	ider simple e.g in which	0.2 6.87
the	re are only 4 i/p training	0.6 0.4
pat	erns	0.5 0.7
The River		0.9 0.3
12,	X2 X3 X4	1741
8	1 - 000 0 00 - + 300 .	
0	0 0 1 Let the	learning time
		l be given by
0		
	0 -1 · 1 · · · · · · · · · · · · · · · ·	= 4(1)
	S suppose	
	Let topological radius R=0:	18-23
100		.
0	For vector 1100 . j.e. X	
M(b)	using Euclidean distance al	gorithm,
100	(2-0-0)000 12.0	
	$D(1) = (1 - 0.2)^{2} + (1 - 0.6)^{2}$	1 (0-0.5)2+(0-0.9)
	= 1.86	1 1 2 2 1 1 2 2
- 34101	$D(2) = (1 - 0.8)^2 + (1 - 0.4)^2$	+ (0-0.7)2+ (0.00.3)
-	2 0.98	
	D(1) > D(0)	
	∴ J=2 as D(1) 7 D(2)	
1	e 101 6 100 7 20 1 1012 1 101	Carl Til

	0.08 0.92 0.64 0.76 0.5 0.28 0.9 0.12
10015	= 0.8 + 0.6 (1 - 0.8)
	= 0.8 +0.6 (120.8)
	Do this for all neighbours of W12
1-01	For # = 0 0 0 1
	using Fucildean Distance algorithm, $D(1) = (0 - 0.08)^2 + (0 - 0.6)^2 + (0 - 0.5)^2 + (1 - 0.9)^2$
	$D(2) = (0-0.92)^{2} + (0-0.76)^{2} + (0+0.28)^{2} + (1-0.0)^{2}$
	2.2768
	the profit paramet are profite or attach
	: J=10 as D(1) < D(2)
	· ω ₂₁ (new) = ω ₂₁ (new) + d (χ ₂ = ω ₂₁ (old))
	= 0.6 + 0.6(0.6)
. am	it naissel 11 = 10,24 . 1)
	demovie and Ital place of o o
	w ₁₁ w ₁₂ 0.08 0.92
	w_{21} w_{22} 0.24 0.76
0.21	w_{4} w_{2} w_{2} w_{2} w_{3} w_{4} w_{2} w_{2} w_{2} w_{3} w_{4} w_{2} w_{2} w_{3} w_{4} w_{2} w_{4} w_{4} w_{2} w_{4} w_{4
	W441 W242 0 0.96 0.12
	rx-9tr -0011 rettavian
	w31 (new) = w31 (old) + x(x3 - w31(old))
	= 0.5 + 0.6(0 - 0.5)
1-11-0-0-1	*8 0-8) 1 ° (=> 0 · 20 · 1 = 1) = 110
	70-1 (50.53 - 11-1) (312 - 215
(20年)	wy (new) = wy (old) + α(χη - wy (old))
	= 0.9 + 0.6(1-0.9)
	(5)0 x (1) 1 21 Seri
	w ₁₁ (new) = ω ₁₁ (old) + α (ω) + -ω ₁₁ (old) = 0.08 + 0.6(0-0.2)



	Date
•	For vector 1000 2
S - 1	using Euclidean distance method.
	$D(1) = (1 - 0.08)^{2} + (0 - 0.24)^{2} + (0.0.20)^{2} + (0.0.9)^{2}$
	- (800 = 0 + 1 8 6 5 6
	$D(2) = (1 - 0.92)^{2} + (0 - 0.76)^{2} + (0 - 0.28)^{2} + (0 - 0.12)$
	= 0.6768
``	
	T = D(2) < D(1), T = 2
	(2) (1) (20) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2
	$\omega_{12}(\text{new}) = \omega_{12}(\text{old}) + \alpha(x_i - \omega_{12}(\text{old}))$
A.	= 0.92 + 0.6(1-0.92)
(di	01, 31 - 22) v. + (1=10.968 . (2001) 11
364	$w_{22}(\text{new}) = w_{22}(\text{old}) + \alpha(\chi_3 - w_{22}(\text{old}))$
	= 0.76 + 0.6(0 - 0.76)
77 h	1) 12 22 - EXC 1 23 - (151-0 - 3104 - C 119 1 1 10 22
12.00	(2004)-17 200 40000
	$w_{23}(\text{new}) = w_{23}(\text{old}) + \alpha(x_3 - w_{23}(\text{old}))$
1197	= 0.28 + 0.6 (0 - 0.28)
aple	
-	(30.0-11306 + 180 =
	$w_{24}(new) = w_{24}(old) + \alpha(\chi_{3} - w_{24}(old))$
	= 0.12 + 0.0(0 - 0.12)
	1 896-7 260=1001-048-100
	DOE-0 DDO 00 F COULT
	ω_{11} ω_{21} 0.08 0.968
	w_{21} w_{22} 0.24 0.304
	ω_{31} ω_{32}
	W41 W42 0.96 0.048]
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0	For vector 0011 jezy
	$D(1) = (-0.08)^{2} + (-0.24)^{2} + (1-0.20)^{2} + (1-0.96)^{2}$ $= 0.7056$
0 0/15	$D(2) = (-0.968)^2 + (-0.304)^2 + (1-0.112)^2$
	+ (0-0.048)2
11-0-01	120-0=120724-111111111111111111111111111111111111
<u> </u>	0370.5
	: D(1) < D(2) :, J=1
Marie America	eret i (tje s (tje .
Chalas	$w_{12}(\text{new}) = w_{11}(\text{old}) + \alpha(x_1 - w_{11}(\text{old}))$
2(010)	= 0.08 + 0.6 (0-0.08)
	(21-0-1) 3 3 4 50 6 6 0 32
	$w_{21}(\text{new}) = w_{21}(\text{old}) + x(x_2 - w_{21}(\text{old}))$
((blo)	2 0.24 + 0.6 (0-0.24)
	(2-0-0)2-0-096
	w3, (new) = w3, (old) + a(x3-w3, (old))
l.	2 0.20+0.6 (1-0.20)
3 (614)	Un = pri) - + (pri) 0 . 68 = (Un 1) = pri
	(and or () 3 40 4 85 00) :
ia.	Wy, (new) 2 Wy, (old) + a (xy - wy, (old))
200	2 0.96 + 0.6 (1-0.96)
((p(q))	1 (1 (1) () + (1 2 0 0 0 8 4) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1) (1 4 1 1 1 1 1) (1 4 1 1 1 1 1) (1 4 1 1 1 1 1 1) (1 4 1 1 1 1 1 1 1) (1 4 1 1 1 1 1 1 1 1 1 1 1) (1 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	W11 W12 00.032 0.968 7
604	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
	2 337 0 048
lg.	18 - 10 C - U8
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Step 2: Now reduce learning rate $\alpha(1) = \alpha(0) = 0.6 = 0.3$ It can be shown that after 100 presentations of all the i/p vector, the final weight matrix is 6.7×10-17 W11 W12 2 x 10-16 0.49 W21 W22 0.51 2.3×10-16 w_{31} w_{32} 1×10-16 Wyl Wys This matrix seems to converge to 0 W12 ω_{μ} 6 0.5 ω_{21} W22 0.5 ω_{32} Wal Ô 1 Ò WHI Wyz cluster1 Cluster 2 Test niw. Suppose the i/p patter is 1100 . then. X1 X2 X3 X4 (luster $D(1) = (0-1)^{2} + (0-1)^{2} + (0.5-0)^{2} + (1-0)^{2}$ = 3.25 0 0 2 $D(2) = (1-1)^2 + (0.5-1)^2 + (0-0)^2 + (0-0)^2$ 0 0 0 1 2 0.25. 10000 2 .. neuron 2 is winner. 11 0-0

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