









$$a = \sum_{j=1}^n w_j x_j + b$$







$$w_j \begin{cases} > 0 & \text{excitatory input} \\ < 0 & \text{inhibitory input} \\ = 0 & \text{no connection} \end{cases}$$





$$a = \sum_{j=1}^n w_j x_j + b = \sum_{j=0}^n w_j x_j = \mathbf{w}^T \mathbf{x}$$

$$y = g(a) = g\left(\sum_{j=0}^n w_j x_j + b\right) = g(\mathbf{w}^T \mathbf{x} + b)$$

2019.09.21

www.vvvo, vvi, vvi, vvi



$$g(x, a) = \frac{1}{1 + e^{-ax}} = \frac{e^{ax}}{1 + e^{ax}} = \begin{cases} 0 & x = -\infty \\ 1/2 & x = 0 \\ 1 & x = \infty \end{cases}, \quad \frac{dg(x)}{dx} = \frac{ae^{-ax}}{(1 + e^{-ax})^2}$$

$$g(x, a) = \frac{2}{1 + e^{-ax}} - 1 = \frac{e^{ax} - 1}{e^{ax} + 1} = \begin{cases} -1 & x = -\infty \\ 0 & x = 0 \\ 1 & x = \infty \end{cases}, \quad \frac{dg(x)}{dx} = \frac{2ae^{-ax}}{(1 + e^{-ax})^2}$$









$$\lim_{a \rightarrow \infty} g(x, a) = \begin{cases} 0 & \text{or } -1 \\ 1 & x \geq 0 \end{cases}$$

$$g(x) = \max(0, x) = \begin{cases} 0 & x < 0 \\ x & x \geq 0 \end{cases}$$



1997-1998

Handwritten text in a cursive script, likely a signature or name, rendered in a pixelated, black and white style. The text is split into two lines: "XERO" on the top line and "XERO" on the bottom line. The characters are stylized and connected, with a prominent 'X' at the beginning of each word.















1992-1993





for the first time.



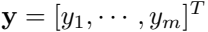






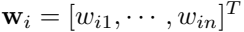
1999

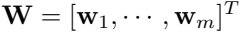




$$y_i = \sum_{j=1}^n w_{ij} x_j = \mathbf{w}_i^T \mathbf{x} \quad (i = 1, \cdots, n),$$







$$v_j^{new} = v_j^{old} + \eta x_j y_j \quad (i = 1, \dots, n, j = 1, \dots, n)$$

www.world + tv











1997-1998

$$w_{ij} = \sum_{k=1}^N x_j^{(k)} y_i^{(k)} \quad (i = 1, \cdots, m, \quad j = 1, \cdots, n)$$



$$\mathbf{W}_{m \times n} = \sum_{k=1}^N \mathbf{y}_k \mathbf{x}_k^T = \sum_{k=1}^N \begin{bmatrix} y_1^{(k)} \\ \vdots \\ y_m^{(k)} \end{bmatrix} [x_1^{(k)}, \cdots, x_n^{(k)}]$$



$$y = \mathbf{W}x_l = \left(\sum_{k=1}^K y_k x_k^T \right) x_l = y_l (x_l^T x_l) + \sum_{k \neq l} y_k (x_k^T x_l)$$



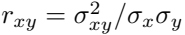
$$x_i^T x_j = ||x_i|| ||x_j|| \cos \phi = \delta_{ij} = \begin{cases} 1 & i=j \\ 0 & i \neq j \end{cases}$$







$$\cos \phi = \frac{x^T y}{\|x\| \|y\|} = \frac{\sum_i x_i y_i}{\sqrt{\sum_i x_i^2} \sqrt{\sum_i y_i^2}}$$

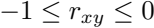












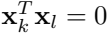






$$y = y_l(x_l^T x_l) + \sum_{k \neq l} y_k(x_k^T x_l) = y_l$$

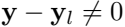


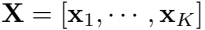












1992-1993

1911-12-12





$$\mathbf{W}_{d \times d} = \frac{1}{d} \sum_{k=1}^K \mathbf{x}_k \mathbf{x}_k^T = \frac{1}{d} \sum_{k=1}^K \begin{bmatrix} x_1^{(k)} \\ \vdots \\ x_d^{(k)} \end{bmatrix} \begin{bmatrix} x_1^{(k)} & \cdots & x_d^{(k)} \end{bmatrix}$$

$$w_{ij} = \frac{1}{d} \sum_{k=1}^K x_i^{(k)} x_j^{(k)} = w_{ji}$$

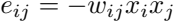
we are equal to our world

$$x_i^{(n+1)} = \operatorname{sgn} \left(\sum_{j=1}^d w_{ij} x_j^{(n)} \right) = \begin{cases} +1, & \text{if } \sum_{j=1}^d w_{ij} x_j^{(n)} \geq 0 \\ -1, & \text{if } \sum_{j=1}^d w_{ij} x_j^{(n)} < 0 \end{cases}$$









$$\mathcal{E}(\mathbf{x}) = \frac{1}{2} \sum_{i=1}^d \sum_{j=1}^d e_{ij} = -\frac{1}{2} \sum_{i=1}^d \sum_{j=1}^d w_{ij} x_i x_j = -\frac{1}{2} \mathbf{x}^T \mathbf{W} \mathbf{x}$$

	x_j	x_i	$w_{ij} > 0$	$w_{ij} < 0$
1	-1	-1	$e_{ij} < 0$	$e_{ij} > 0$
2	-1	1	$e_{ij} > 0$	$e_{ij} < 0$
3	1	-1	$e_{ij} > 0$	$e_{ij} < 0$
4	1	1	$e_{ij} < 0$	$e_{ij} > 0$











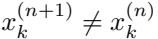




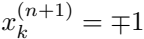












$$x(n+1) \neq x(n)$$



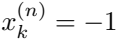


$$-\frac{1}{2}\left[\sum_{i\neq k}\sum_{j\neq k}w_{ij}x_i^{(n)}x_j^{(n)}+\sum_iw_{ik}x_i^{(n)}x_k^{(n)}+\sum_jw_{kj}x_k^{(n)}x_j^{(n)}\right]$$

$$-\frac{1}{2} \sum_{i \neq k} \sum_{j \neq k} w_{ij} x_i x_j - \sum_i w_{ik} x_i^{(n)} x_k^{(n)}$$

$$E^{(n+1)}(x) = -\frac{1}{2} \sum_{i \neq k} \sum_{j \neq k} w_{ij} x_i x_j - \sum_i w_{ik} x_i^{(n+1)} x_k^{(n+1)}$$

$$\Delta \mathcal{E} = (x_k^{(n)} - x_k^{(n+1)}) \sum_i w_{ik} x_i$$



1

WWE

20

A pixelated, black and white representation of the mathematical equation $x^2 + 1 = 1$. The equation is composed of several distinct parts: a variable 'x' on the left, a superscript '2' indicating a square, a plus sign '+', a constant '1', an equals sign '=', and another constant '1' on the right. The entire image has a low-resolution, dithered appearance, reminiscent of early computer graphics or a low-quality scan of a printed document.

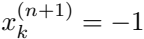
$$x^2 + 1 = 1$$

$$x(n+1) = x(n+1) - 2x(n) + x(n-1)$$





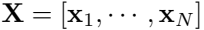
WIPED



$$x(x+1) = 2 \times 2 = 0$$

A row of seven grayscale images showing handwritten digits 1 through 7. Each digit is rendered in a noisy, pixelated style, characteristic of a low-resolution or corrupted scan. The digits are arranged horizontally from left to right.

$$\mathcal{E}(\mathbf{x}) = -\frac{1}{2}\mathbf{x}^T\mathbf{W}\mathbf{x} = -\frac{1}{2}\mathbf{x}^T\left[\frac{1}{d}\sum_{k=1}^K\mathbf{x}_k\mathbf{x}_k^T\right]\mathbf{x} = -\frac{1}{2d}\sum_{k=1}^K\mathbf{x}^T\mathbf{x}_k\mathbf{x}_k^T\mathbf{x} = -\frac{1}{2d}\sum_{k=1}^K(\mathbf{x}^T\mathbf{x}_k)^2$$











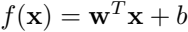
2023.09.01











$$f(x) = w^T x + b \begin{cases} \geq 0 \\ < 0 \end{cases} ;$$

$$\hat{y} = \text{sign}(f(x)) = \begin{cases} 1 & \text{for } x \in C_+ \\ -1 & \text{for } x \in C_- \end{cases}$$















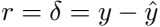
$$p_w(x) = \frac{w^T x}{\|w\|} > -\frac{b}{\|w\|} = b'$$

$$p_w(x) = \frac{w^T x}{\|w\|} < -\frac{b}{\|w\|} = b'$$



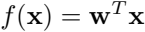








1001, 1002, 1003

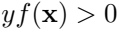


$$w_{new} = w_{old} + \eta(v - v')x = w_{old} + \eta \delta x$$



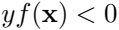


	y	$f(\mathbf{x}) = \mathbf{w}^T \mathbf{x}, \hat{y} = \text{sign}(f(\mathbf{x}))$	$\delta = y - \hat{y}$
1	$y = 1$	$f(\mathbf{x}) > 0, \hat{y} = 1$	$\delta = 0$
2	$y = -1$	$f(\mathbf{x}) > 0, \hat{y} = 1$	$\delta = -2$
3	$y = 1$	$f(\mathbf{x}) < 0, \hat{y} = -1$	$\delta = 2$
4	$y = -1$	$f(\mathbf{x}) < 0, \hat{y} = -1$	$\delta = 0$

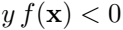




new word + old word











$$f(x) = x^{\text{new}} = x^{\text{old}} - 2x^{\text{old}}$$



www.world + earth

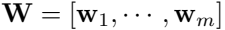
$$f(x) = x^{\text{new}} = x^{\text{old}} + 2x^{\text{old}}$$

www.evv - www + 2x



$$y f(x) \begin{cases} > 0 \\ < 0 \end{cases}$$

$$\begin{cases} w_{new} = w_{old} \\ w_{new} = w_{old} + yx \end{cases}$$



we are in the world









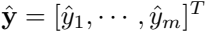




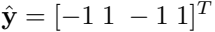


binary output	y_0	y_1	y_2	y_3
y_1	1	-1	-1	-1
y_2	-1	1	-1	-1
y_3	-1	-1	1	-1
y_4	-1	-1	-1	1

binary output	y_0	y_1	y_2	y_3
y_1	-1	-1	1	1
y_2	-1	1	-1	1





































new world + spin





$$W = \sum_{n=1}^N a_n y_n x_n$$





$$f(x_l) = w^T x_l = \sum_{n=1}^N a_n y_n x_n^T x_l,$$

WISCONSIN



$$w^{new} = w^{old} + y_l x_l = \sum_{n=1}^N a_n y_n x_n + y_l x_l$$

original

=

original

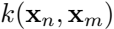
+

1

$$w^T x = \sum_{n=1}^N a_n y_n x_n^T x \begin{cases} > 0 \\ < 0 \end{cases},$$

$$x \in \{c_-, c_+\}$$





1920-1921











$$z_j = g(a_j^h) = g\left(\sum_{k=1}^d w_{jk}^h x_k + b_j^h\right) = g\left(\sum_{k=0}^d w_{jk}^h x_k\right) = g(\mathbf{x}^T \mathbf{w}_j^h) \quad (j = 1, \cdots, l)$$

$\frac{1}{2} \log \frac{1}{2}$

$$w_j = [w_{j0}, w_{j1}, \dots, w_{jd}]^T$$

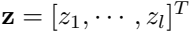
Qb

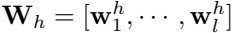
=

XI

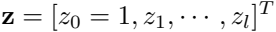
Wb

EWART'S





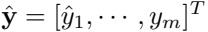
$$\hat{y}_i = g(a_i^o) = g\left(\sum_{j=1}^l w_{ij}^o z_j + b_i^o\right) = g\left(\sum_{j=0}^l w_{ij}^o z_j\right) = g(\mathbf{z}^T \mathbf{w}_i^o) \quad (i = 1, \cdots, m)$$



www. [vivo - vivo, . , vivo]



WWE IS



$v_1, v_2 = 1, 0, 1, 0, 1, 0, 1, 0$



$$\frac{1}{2}||\mathbf{y}-\hat{\mathbf{y}}||^2=\frac{1}{2}\sum_{i=1}^m(\hat{y}_i-y_i)^2=\frac{1}{2}\sum_{i=1}^m[g(a_i^o)-y_i]^2=\frac{1}{2}\sum_{i=1}^m\left[g\left(\sum_{j=0}^l w_{ij}^o z_j\right)-y_i\right]^2$$

$$\frac{1}{2} \sum_{i=1}^m \left[g \left(w_{i0}^o + \sum_{j=1}^l w_{ij}^o g(a_j^h) \right) - y_i \right]^2 = \frac{1}{2} \sum_{i=1}^m \left[g \left(w_{i0}^o + \sum_{j=1}^l w_{ij}^o g \left(\sum_{k=0}^n w_{jk}^h x_k \right) \right) - y_i \right]^2$$

$$v_j = 1, \quad n_j = 0, \quad 1, \quad j = 0, 1, \quad ; \quad v_j = 0, \quad 1, \quad ; \quad n_j = 1, \quad ;$$

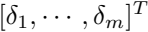
$$\frac{\partial \epsilon}{\partial w_{ij}^0} = \frac{\partial \epsilon}{\partial \hat{y}_i} \frac{\partial \hat{y}_i}{\partial a_i^0} \frac{\partial a_i^0}{\partial w_{ij}^0} = (\hat{y}_i - y_i) g'(a_i^0) z_j = -\delta_i g'(a_i^0) z_j$$



$$w_{ij}^{o(new)} = w_{ij}^{o(old)} - \eta \frac{\partial e}{\partial w_{ij}^o} = w_{ij}^{o(old)} + \eta \delta_i g'(a_i^o) z_j$$

$$w_{nx}^{o(new)}(l+1) = w_{nx}^{o(old)} + \eta d_{nx1}(z^T)1 \times (l+1)$$

$d_n \times 1 = [d_1 d_2 \dots d_n]$



WORLD OF WARRIORS



$$v_x = 0 = 1, \quad v_x = 0, 1, \quad v_x = 0, 1,$$

$$\partial \epsilon$$

$$\partial v^h_{jk}$$

$$\frac{\partial \varepsilon}{\partial \hat{y}_i} \frac{\partial \hat{y}_i}{\partial a_i^o} \frac{\partial a_i^o}{\partial z_j} \frac{\partial z_j}{\partial a_j^h} \frac{\partial a_j^h}{\partial w_{jk}^h} = \sum_{i=1}^m (\hat{y}_i - y_i) \frac{\partial \hat{y}_i}{\partial a_i^o} \frac{\partial a_i^o}{\partial z_j} \frac{\partial z_j}{\partial a_j^h} \frac{\partial a_j^h}{\partial w_{jk}^h}$$

$$-\sum_{i=1}^m \delta_i g'(a_i^o) w_{ij}^o g'(a_j^h) x_k = -\delta_j^h g'(a_j^h) x_k$$

$$\delta_j^h = \sum_{i=1}^m \delta_i^o g'(a_i^o) w_{ij}^o = \sum_{i=1}^m d_i^o w_{ij}^o \quad (j = 1, \cdots, l)$$

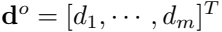


$$\begin{bmatrix} \delta_1^h \\ \vdots \\ \delta_l^h \end{bmatrix} = \begin{bmatrix} w_{11}^o & \cdots & w_{1m}^o \\ \vdots & \ddots & \vdots \\ w_{l1}^o & \cdots & w_{lm}^o \end{bmatrix} \begin{bmatrix} \delta_1^o g'(a_1^o) \\ \vdots \\ \delta_m^o g'(a_m^o) \end{bmatrix} = \mathbf{W}_{l \times m}^{oT} \mathbf{d}_{m \times 1}^o$$












9202

10 = 1000000

$$w_{jk}^{h(new)} = w_{jk}^{h(old)} - \eta \frac{\partial \epsilon}{\partial w_{jk}} = w_{jk}^{h(old)} + \eta \delta_j^h g'(a_j^h) x_k = w_{jk}^{h(old)} + \eta d_j^h x_k$$

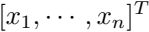


$$w_{lx(d+1)}^{h(new)} = w_{lx(d+1)}^{h(old)} + \eta d_l^h x_1^T x_{(d+1)}$$



0 1 2 3 4





1999-2000

1 = 100%





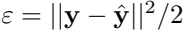
W E W O E

do not do bad

WOW!!!

www. + 7 0 2 1 2

www.oxfordjournals.org













A pixelated, black and white graphic of the text "I Wish I Were A". The text is rendered in a stylized, blocky font with a dithered or pixelated appearance, giving it a retro, digital feel. The letters are thick and the spacing is consistent. The entire text is centered horizontally within the image.





1

2

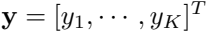
30



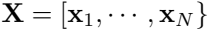
$$\begin{bmatrix} 185 & 14 & 1 \\ 5 & 181 & 14 \\ 11 & 33 & 156 \end{bmatrix}$$

$$\begin{bmatrix} 176 & 24 \\ 22 & 178 \end{bmatrix}$$

$$\begin{bmatrix} 216 & 0 & 2 & 1 & 0 & 0 & 4 & 0 & 1 & 0 \\ 0 & 212 & 0 & 1 & 0 & 1 & 3 & 0 & 7 & 0 \\ 0 & 0 & 221 & 0 & 0 & 0 & 1 & 0 & 2 & 0 \\ 1 & 0 & 1 & 203 & 0 & 0 & 0 & 0 & 14 & 5 \\ 0 & 0 & 0 & 0 & 221 & 0 & 1 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 & 2 & 214 & 0 & 0 & 6 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 221 & 0 & 2 & 0 \\ 0 & 0 & 4 & 0 & 0 & 0 & 0 & 214 & 4 & 2 \\ 0 & 0 & 1 & 0 & 0 & 1 & 1 & 0 & 221 & 0 \\ 0 & 0 & 0 & 1 & 2 & 0 & 0 & 0 & 4 & 217 \end{bmatrix}$$



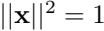
WORLD 13





$$a_i = \sum_{j=1}^n w_{ij} x_j = \mathbf{w}_i^T \mathbf{x} = ||\mathbf{w}_i|| ||\mathbf{x}|| \cos \theta \quad (i = 1, \cdots, K)$$

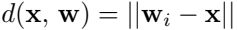






$$y_i = \begin{cases} 1 & \text{if } a_i = \mathbf{w}_i^T \mathbf{x} = \max_j \mathbf{w}_j^T \mathbf{x} \\ 0 & \text{otherwise} \end{cases} \quad (i = 1, \dots, K)$$





Q

R

W

U

V

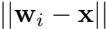
X

Y

$$\frac{1}{2} \|w_0 - x\|^2 = \frac{1}{2} (w_0 - x)^T (w_0 - x) = \frac{1}{2} w_0^T w_0 - w_0^T x + \frac{1}{2} x^T x$$

$$||w_z||^2 + ||x||^2 - 2||w_z||^2 ||x||^2 = ||w_z||^2 + ||x||^2 - 2||w_z|| ||x|| \cos \theta$$





$$y_i = \begin{cases} 1 & \text{if } \|w_i - x\| = \min_j \|w_j - x\| \\ 0 & \text{otherwise} \end{cases} \quad (i = 1, \dots, K)$$

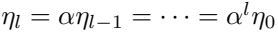
$$w_i^{new} = w_i^{old} + y_i \eta (x - w_i^{old}) = \begin{cases} (1 - \eta) w_i^{old} + \eta x & \text{if } y_i = 1 \\ w_i^{old} & \text{if } y_i = 0 \end{cases}$$











WORLDWIDE

World

WOW! WOW! WOW!



Q = W + X

Q = 1, 2, 3, 4

0 1 2 3 4 5 6 7 8 9

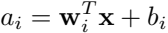
$$w_2 + 1 = w_2 + w_2 x - w_2 x$$



A pixelated, black and white representation of the mathematical expression $W(1 + 1)^2$. The characters are rendered in a blocky, digital font style. The 'W' is on the left, followed by an opening parenthesis '(', then the number '1', a plus sign '+', another '1', a closing parenthesis ')', and finally a superscripted '2'.











$$b_i = c \left(\frac{1}{K} - \frac{\text{number of winnings of node } i}{\text{total number iterations so far}} \right)$$









151515





$$w_{new} = w_{old} + \eta (x - w_{old}) \quad i = 1, \dots, N$$



$$u_{ik} = \exp\left(-\frac{d_{ik}^2}{2\sigma^2}\right) \begin{cases} = 1 & \text{if } i = k \text{ and } d_{ik} = 0 \\ < 1 & \text{else} \end{cases}$$











