









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







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





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

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

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 letters are stylized and connected, with a prominent 'X' at the beginning of each word.















1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100.



for the first time.



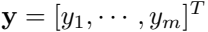






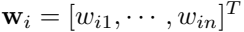
1999-2000

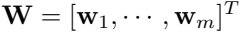




$$y_i = \sum_{j=1}^n w_{ij} x_j = \mathbf{w}_i^T \mathbf{x} \quad (i = 1, \cdots, n),$$







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

www.world + tv











1992-1993

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



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



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



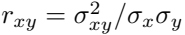
$$x_i^T x_j = ||x_i|| ||x_j|| \cos \phi = \delta_{ij} = \begin{cases} 1 & i=j \\ 0 & i \neq j \end{cases}$$







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

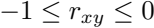


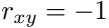










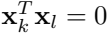






$$y = y_l(x_l^T x_l) + \sum_{k \neq l} y_k(x_k^T x_l) = y_l$$

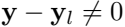


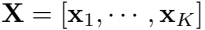


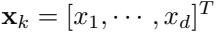












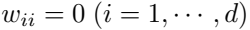
2015-11-10





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

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

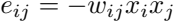


$$x_i^{(n+1)} = \operatorname{sgn} \left(\sum_{j=1}^d w_{ij} x_j^{(n)} \right) = \begin{cases} +1, & \text{if } \sum_{j=1}^d w_{ij} x_j^{(n)} \geq 0 \\ -1, & \text{if } \sum_{j=1}^d w_{ij} x_j^{(n)} < 0 \end{cases}$$









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

| | 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 | $e_{ij} < 0$ | $e_{ij} > 0$ |











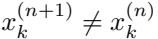




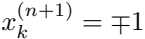












$$x(n+1) = x(n)$$



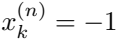


$$-\frac{1}{2}\left[\sum_{i\neq k}\sum_{j\neq k}w_{ij}x_i^{(n)}x_j^{(n)}+\sum_iw_{ik}x_i^{(n)}x_k^{(n)}+\sum_jw_{kj}x_k^{(n)}x_j^{(n)}\right]$$

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

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

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





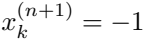
$$x^2(x+1) = 1$$

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



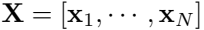


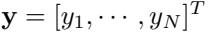
WIPED



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

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













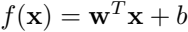
2023年12月20日











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

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















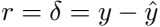
$$p_w(x) = \frac{w^T x}{\|w\|} \geq - \frac{b}{\|w\|} = b'$$

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





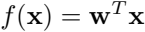






1001, 1002, 1003

$\mathbb{W} = \left[\begin{matrix} \mathbf{w}_0 & \mathbf{w}_1 & \dots & \mathbf{w}_n \end{matrix} \right]$



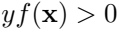
$$w_{new} = w_{old} + \eta(v - \hat{v})x = w_{old} + \eta \sigma x$$





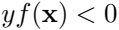


| | y | $f(\mathbf{x}) = \mathbf{w}^T \mathbf{x}, \hat{y} = \text{sign}(f(\mathbf{x}))$ | $\delta = y - \hat{y}$ |
|---|----------|---|------------------------|
| 1 | $y = 1$ | $f(\mathbf{x}) > 0, \hat{y} = 1$ | $\delta = 0$ |
| 2 | $y = -1$ | $f(\mathbf{x}) > 0, \hat{y} = 1$ | $\delta = -2$ |
| 3 |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

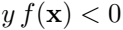




new word + old word











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



www.world + earth

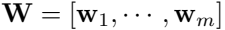
$$f(x) = x^{\text{new}} = x^{\text{old}} + 2x^{\text{old}}$$

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









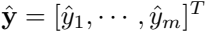




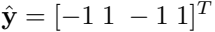


| binary output | y_0 | y_1 | y_2 | y_3 |
|---------------|-------|-------|-------|-------|
| y_1 | 1 | -1 | -1 | -1 |
| y_2 | -1 | 1 | -1 | -1 |
| y_3 | -1 | -1 | 1 | -1 |
| y_4 | -1 | -1 | -1 | 1 |

| 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

+

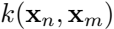
1

A pixelated, black and white graphic of the text "100% 100%". The characters are rendered in a bold, blocky font with a dithered or pixelated texture. The first "100%" is on the left, followed by a space, then another "100%". The overall style is reminiscent of early digital art or low-resolution computer graphics.

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

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





1920-1921











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

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

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

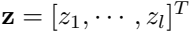
Qb

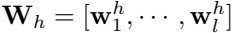
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XI

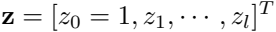
Wb

EWART'S





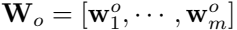
$$\hat{y}_i = g(a_i^o) = g\left(\sum_{j=1}^l w_{ij}^o z_j + b_i^o\right) = g\left(\sum_{j=0}^l w_{ij}^o z_j\right) = g(\mathbf{z}^T \mathbf{w}_i^o) \quad (i = 1, \cdots, m)$$

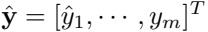


www. [vivo - vivo, . , vivo]



WWE IS





$v_{\pi} = 1, v_{K} = 0, 1, v_{\pi} = 1, v_{K} = 0, 1, v_{\pi} = 1, v_{K} = 0, 1$



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

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

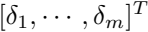
$$\frac{\partial \epsilon}{\partial w_{ij}^0} = \frac{\partial \epsilon}{\partial \hat{y}_i} \frac{\partial \hat{y}_i}{\partial a_i^0} \frac{\partial a_i^0}{\partial w_{ij}^0} = (\hat{y}_i - y_i) g'(a_i^0) z_j = -\delta_i g'(a_i^0) z_j$$



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

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

$$d_n \times 1 = [d_1 d_2 \dots d_n] \cdot [d_1 d_2 \dots d_n]^T$$



WORLD OF WISDOM



$$\partial \epsilon$$

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

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

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

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

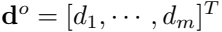


$$\begin{bmatrix} \delta_1^h \\ \vdots \\ \delta_l^h \end{bmatrix} = \begin{bmatrix} w_{11}^o & \cdots & w_{1m}^o \\ \vdots & \ddots & \vdots \\ w_{l1}^o & \cdots & w_{lm}^o \end{bmatrix} \begin{bmatrix} \delta_1^o g'(a_1^o) \\ \vdots \\ \delta_m^o g'(a_m^o) \end{bmatrix} = \mathbf{W}_{l \times m}^{oT}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











9201

10 = 1000000000

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

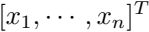


$$w_{lx(d+1)}^{h(new)} = w_{lx(d+1)}^{h(old)} + \eta d_l^h x_l^T x_{l(d+1)}$$

A pixelated, black and white graphic of the text "d = W dot x_m dot 1". The text is rendered in a stylized, hand-drawn font with a dithered or pixelated appearance. The characters are bold and blocky, with visible pixel boundaries. The equals sign is represented by two horizontal lines. The dot operators are small circles. The subscripts 'm' and '1' are clearly visible. The overall style is reminiscent of early computer graphics or digital art.

0 1 2 3 4





1999-2000

1997-2000





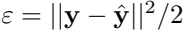
W E W O E

[illegible]

WOW! X1

www.ripodex.it

www.oxfordjournals.org













[illegible]





1

2

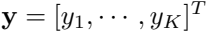
30



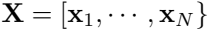
$$\begin{bmatrix} 185 & 14 & 1 \\ 5 & 181 & 14 \\ 11 & 33 & 156 \end{bmatrix}$$

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

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



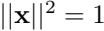
WORLD 13





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

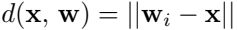






$$y_i = \begin{cases} 1 & \text{if } a_i = \mathbf{w}_i^T \mathbf{x} = \max_j \mathbf{w}_j^T \mathbf{x} \\ 0 & \text{otherwise} \end{cases} \quad (i = 1, \dots, K)$$





Q

R

W

U

V

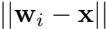
X

Y

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

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





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

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









71 = 071-1 = 0711

WORLDWIDE

World

WOW! WOW! WOW!



Q = WXZ
V = 1, , V)

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 superscript '2' at the bottom right.











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









151515





$$w_{new} = w_{old} + \eta(x - w_{old})^2 = 1, \dots, N$$



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











