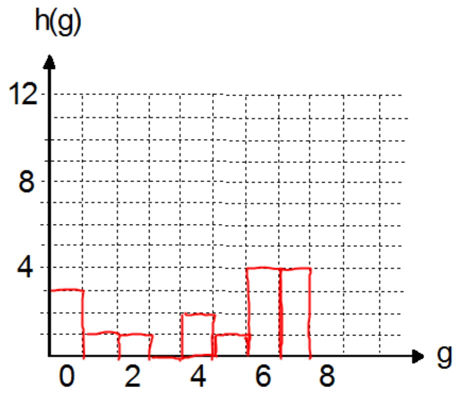
Aufgabe 1 : SS2009 / 1d

2	3	4	4
3	3	5	5
4	5	6	7
4	5	7	1



XOR mit

$0000\ 0011_B$

In	Bin	Bin	Out	Häufigkeit
0	0 00	011	3	0
1	0 01	010	2	1
2	0 10	001	1	1
3	0 11	000	0	3
4	1 00	111	7	4
5	1 01	110	6	4
6	1 10	101	5	1
7	1 11	100	4	2
				Σ 16

werden invertiert

Aufgabe 2 : SS 2009/3

a) 2 Gleichungen aufstellen $\quad Ax + By = 1$

$$\begin{aligned} A \cdot 0 + B \cdot 100 &= 1 \\ A \cdot 150 + B \cdot 200 &= 1 \end{aligned} \quad \Rightarrow \quad \begin{pmatrix} 0 & 100 \\ 150 & 200 \end{pmatrix} \begin{pmatrix} A \\ B \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$100\,B = 1 \quad \Leftrightarrow \quad \underline{\underline{B = 0.01}}$$

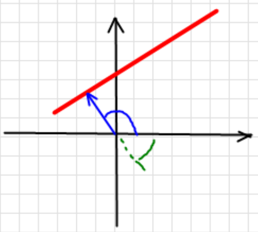
$$150\,A + 200 \cdot 0.01 = 1 \quad \Leftrightarrow \quad \underline{\underline{A = -\frac{1}{150}}}$$

b)
$$\left.\begin{aligned} Ax + By &= 1 \\ \frac{\cos\Theta}{r} + \frac{\sin\Theta}{r} &= 1 \end{aligned}\right\} \Rightarrow \quad A = \frac{\cos\Theta}{r} \qquad B = \frac{\sin\Theta}{r}$$

$$\frac{B}{A} = \frac{\sin\Theta}{\cos\Theta} = \tan\Theta \quad \Leftrightarrow \quad \Theta = \arctan\frac{B}{A}$$

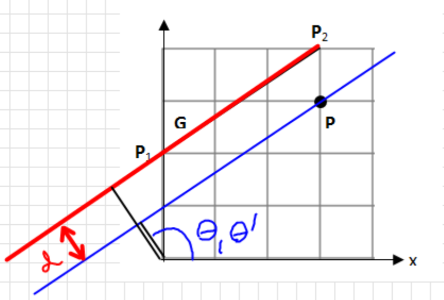
$$\Theta = \arctan\left(-\frac{150}{100}\right) = \underline{\underline{-56.3^\circ}}$$

Taschenrechner!



$$\Rightarrow \quad \underline{\underline{\Theta}} = 180^\circ - 56.3^\circ = \underline{\underline{123.7^\circ}}$$

$$\underline{\underline{r}} = \frac{\sin\Theta}{B} = \underline{\underline{83.2}}$$



$\theta = \theta'$ (parallel)

$r' = x_p \cos\theta + y_p \sin\theta$

$r' = 150 \cdot \cos 123.7^\circ + 150 \cdot \sin 123.7^\circ$

$\underline{\underline{r' = 41.57}}$

$\underline{d} = |r - r'| = 83.2 - 41.57 \approx \underline{\underline{41.6}}$

Aufgabe 3 : WS 2009/2

(1) $x_v = x_k \cdot (1 + a_1 r_k^2 + a_2 r_k^4)$ mit $r_k = \sqrt{x_k^2 + y_k^2}$ $\quad r_K$: Zentrumsabstand

(2) $y_v = y_k \cdot (1 + b_1 r_k^2 + b_2 r_k^4)$

Nr.	verzeichneter Punkt (Index v: verzeichnet)	korrigierter Punkt (Index k: korrigiert)	r_k^2	r_k^4
1	(0.55, 0.52)	(0.50, 0.50)	0.5	0.25
2	(1.20, 0.27)	(1.00, 0.25)	1.0625	1.129

1 : $\quad r_K^2 = x_K^2 + y_K^2 = 0.5 \qquad r_K^4 = (r_K^2)^2 = 0.25$

2 : $\quad r_K^2 = x_K^2 + y_K^2 = 1.0625 \qquad r_K^4 = (r_K^2)^2 = 1.129$

mit (1)

$$0.55 = 0.5 \cdot (1 + a_1 \cdot 0.5 + a_2 \cdot 0.25)$$
$$1.20 = 1.0 \cdot (1 + a_1 \cdot 1.0625 + a_2 \cdot 1.129)$$

ausmultiplizieren und sortieren

$$\left.\begin{aligned} 0.05 &= 0.25\, a_1 + 0.125\, a_2 \\ 0.20 &= 1.0625\, a_1 + 1.129\, a_2 \end{aligned}\right\} \quad \begin{pmatrix} 0.25 & 0.125 \\ 1.0625 & 1.129 \end{pmatrix} \begin{pmatrix} a_1 \\ a_2 \end{pmatrix} = \begin{pmatrix} 0.05 \\ 0.20 \end{pmatrix}$$

Lösen mit der Determinantenmethode :

$D_H = 0.1494$

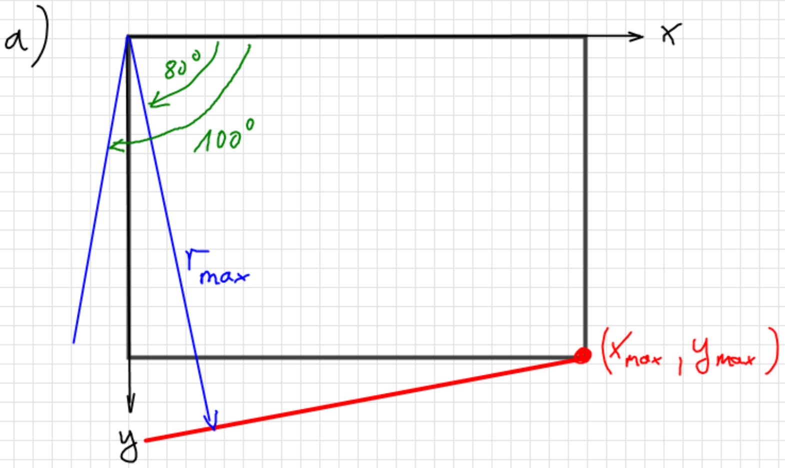
$D_1 = 31.25 \cdot 10^{-3}$

$D_2 = -3.125 \cdot 10^{-3}$

$$a_1 = \frac{D_1}{D_H} = 0.211$$
$$a_2 = \frac{D_2}{D_H} = -0.021$$

Aufgabe 4 : WS 2009/7

a)



$$r_{max} = x_{max} \cos\Theta + y_{max} \sin\Theta = 1199 \cos 80° + 799 \cdot \sin\Theta$$

$$r_{max} \approx 995$$

$r \in [0, 995]$ $\qquad \Theta \in [80°, 100°]$

b)

1*) bei Punkten nahe der x-Achse

if g[x,y] > Kantenschwelle **then**

for $\Theta = 80° \ldots 100°$ Step 0.5° do

  $r = \text{round}(x \cos\Theta + y \sin\Theta)$ 1*

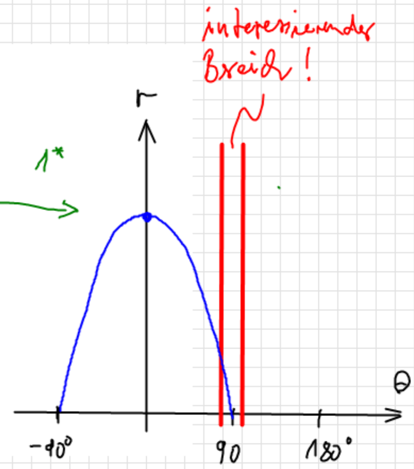
  if $(r \geq 0)$ ←— wegen —→

    $A(r,\Theta) = A(r,\Theta) + 1$

  endif

endfor

endif



Aufgabe 5 : SS 2009/7

a) Gewinnerneuron $\Rightarrow a$

$$\vec{W}(t+1) = \vec{W}(t) + \eta \cdot \tau_{ij} \cdot \left[\vec{x}(t) - \vec{w}(t) \right]$$

$$\tau_{ij} = e^{-\frac{d^2}{2\sigma}}$$

b) $\underline{\underline{\vec{W}_a(t+1)}} = (0.8, 0.5) + 0.5 \cdot 1 \cdot \left[(0.8, 0.7) - (0.8, 0.5) \right]$

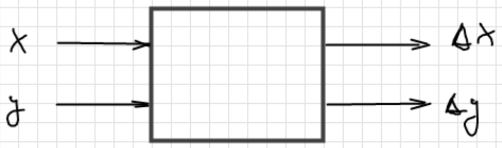
$$= (0.8, 0.5) + \frac{1}{2} \cdot (0, 0.2) = \underline{\underline{(0.8, 0.6)}}$$

c) $d_{ac} = e^{-\frac{\sqrt{2}^2}{2\sigma^2}} = e^{-1}$

$\underline{\underline{\vec{W}_c(t+1)}} = (0.4, 0.7) + 0.5 \cdot e^{-1} \cdot \left[(0.8, 0.7) - (0.4, 0.7) \right]$

$$= (0.4, 0.7) + 0.184 \cdot (0.4, 0) = \underline{\underline{(0.474, 0.7)}}$$

Aufgabe 6 : SS 2011/6



$\Rightarrow$ 2 Funktionen

$\Delta x(x,y)\ ,\ \Delta y(x,y)$

Fünf Stützpunkte $\Rightarrow$ fünf $h(x,y)$

$$h_1(x,y) = e^{-\left[\frac{(x-30)^2}{2\sigma^2} - \frac{(y-20)^2}{2\sigma^2}\right]}$$

$$\vdots$$

$$h_5(x,y) = e^{-\left[\frac{(x-90)^2}{2\sigma^2} - \frac{(x-80)^2}{2\sigma^2}\right]}$$

$$\Delta x(x,y) = \frac{-10\, h_1(x,y) + 9\, h_2(x,y) - \dots + 7\, h_5(x,y)}{h_1(x,y) + \dots + h_5(x,y)}$$

$$\Delta y(x,y) = \frac{-10\, h_1(x,y) - 11\, h_2(x,y) + \dots + 12\, h_5(x,y)}{h_1(x,y) + \dots + h_5(x,y)}$$

Aufgabe 7 : WS 2011/5

a) $\mu_{H_{niedrig}} = 0.5 \qquad \mu_{H_{hoch}} = 0.5$

$\mu_{L_{klein}} = 0.8 \qquad \mu_{L_{groß}} = 0.2$

b) alle Regeln

c) $R_1 : \quad \varepsilon_{nk} = \min(0.5,\ 0.8) = 0.5$

$R_2 : \quad \varepsilon_{ng} = \min(0.5,\ 0.2) = 0.2$

$R_3 : \quad \varepsilon_{hk} = \min(0.5,\ 0.8) = 0.5$

$R_4 : \quad \varepsilon_{hg} = \min(0.5,\ 0.2) = 0.2$

d) $\left.\begin{array}{l} \varepsilon_{nk} = 0.5 \Longrightarrow \text{Lads} = \text{hoch} \\ \varepsilon_{ng} = 0.2 \Longrightarrow \text{Lads} = \text{hoch} \end{array}\right\} \alpha_h = \max(0.5, 0.2) = \underline{\underline{0.5}}$

$\varepsilon_{hk} = 0.5 \Longrightarrow \text{Lads} = \text{mittel} \qquad \alpha_m = \underline{\underline{0.5}}$

$\varepsilon_{hg} = 0.2 \Longrightarrow \text{Lads} = \text{klein} \qquad \alpha_k = \underline{\underline{0.2}}$

e) $$\underline{\underline{\text{Lads}}} = \frac{0.5 \cdot 1 + 0.5 \cdot 0.5 + 0.2 \cdot 0}{0.5 + 0.5 + 0.2} = \underline{\underline{0.625}}$$

Aufgabe 8 : WS 11 12/5

$$u\,(x + b y + 1) = a x + 4y - 5 \qquad \text{gesucht}$$
$$u x + u y b + u = a x + 4y - 5$$
$$u x + u + 5 - 4y = a x - b\, u y$$

Mit den 3 Bildkoordinatenpaaren:

$$2 + 2 + 5 - 4 = a - b \cdot 2 \qquad (1)$$
$$2 + 1 + 5 - 4 = a \cdot 2 - b \qquad (2)$$
$$1 + 1 + 5 - 8 = a - b \cdot 2 \qquad (3)$$

$$\begin{pmatrix} 1 & -2 \\ 2 & -1 \\ 1 & -2 \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 5 \\ 4 \\ -1 \end{pmatrix} \qquad \underline{A} \cdot \vec{\xi} = \vec{b}$$

Überbestimmt, daher lösen mit $\underline{A}^T \underline{A}\, \vec{\xi} = \underline{A}^T \vec{b}$

$$\begin{pmatrix} 1 & 2 & 1 \\ -2 & -1 & -2 \end{pmatrix} \begin{pmatrix} 1 & -2 \\ 2 & -1 \\ 1 & -2 \end{pmatrix} \cdot \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 1 & 2 & 1 \\ -2 & -1 & -2 \end{pmatrix} \begin{pmatrix} 5 \\ 4 \\ -1 \end{pmatrix}$$

$$\begin{pmatrix} 6 & -6 \\ -6 & 9 \end{pmatrix} \cdot \begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 12 \\ -12 \end{pmatrix}$$

Lösen mit Determinantenmethode: $D_A = 18$

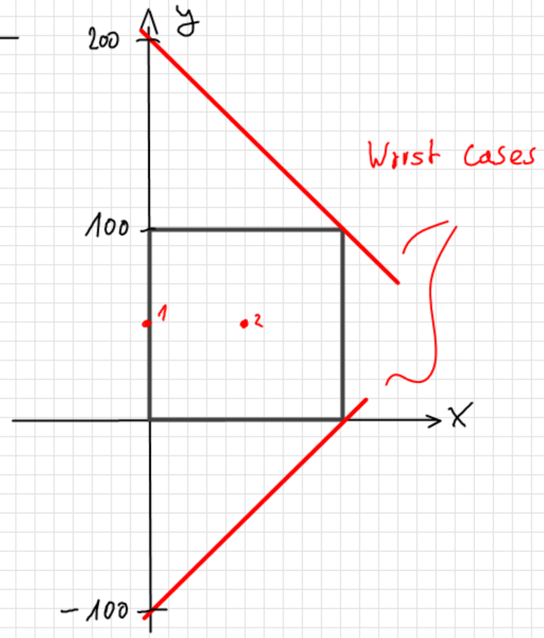
$$D_1 = \begin{vmatrix} 12 & -6 \\ -12 & 9 \end{vmatrix} = 36 \qquad D_2 = \begin{vmatrix} 6 & 12 \\ -6 & -12 \end{vmatrix} = 0$$

$$\left.\right\} \quad \underline{\underline{a = \frac{36}{18} = 2}} \qquad \underline{\underline{b = \frac{0}{18} = 0}}$$

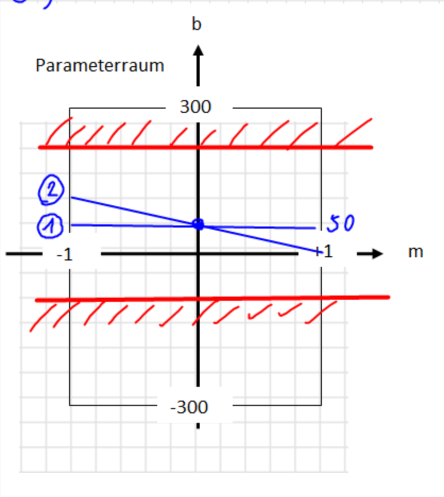
Aufgabe 9 : WS 11 12 / 9

$y = m x + b$

a) $b \in [-100, +200]$



b)



$b = \underbrace{-x}_{\text{Steigg.}} m + y$ ⇒ Gerade

Achsenabschnitt bei $m = 0$

c)

for $j = 1, n$ do // alle gesetzten Bildpunkte

for $m = -1 \ldots +1$ step Δm do

$b = -m x_j + y_j$

$A(m, b) = A(m, b) + 1$

end for

end for