

Neural nets

$$f(\bar{x}) = [g \ b \ n]$$

good

1 0 0

bad

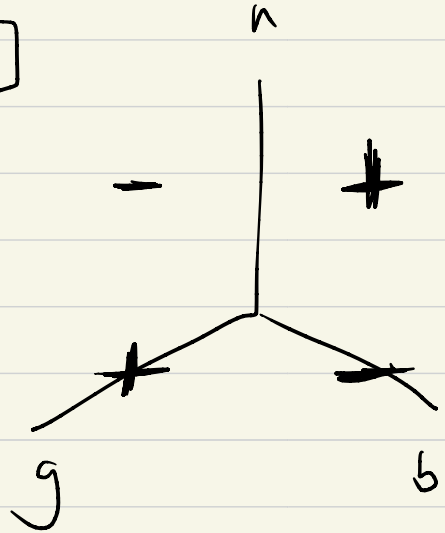
0 1 0

not good

1 0 1

not bad

0 1 1



Nonlinear classifiers

$$\bar{w}^T f(\bar{x})$$

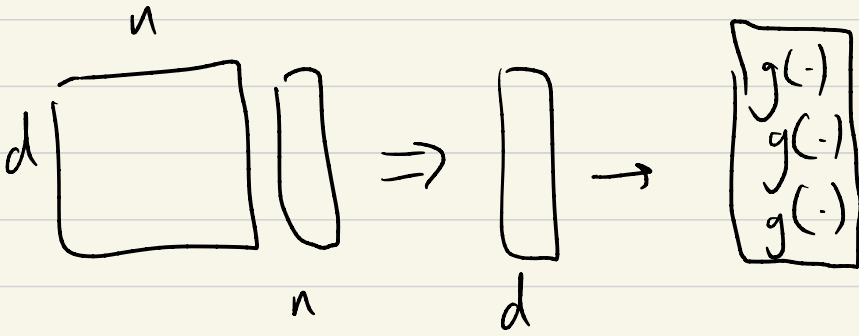
expand

intermediate features

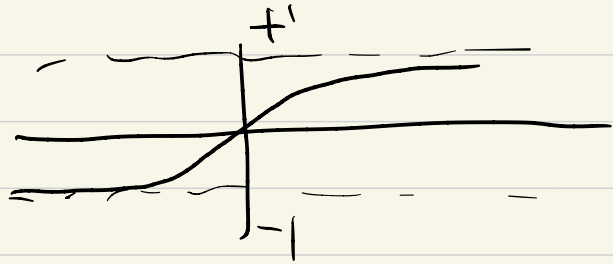
$$\bar{z} = g(V f(\bar{x}))$$

nonlinearity

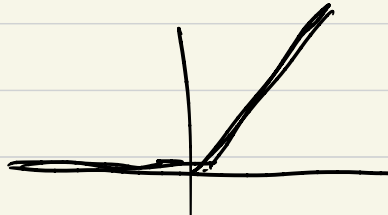
Bow feats, n feats
 $d \times n$ matrix

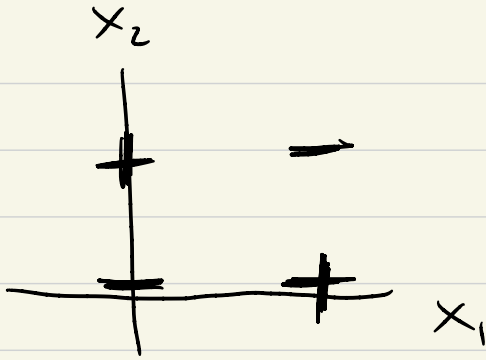


$g: \tanh$



ReLU





(I created)

0	0	-
0	1	+
1	0	+
1	1	-

$$V = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$$

$$Vf(\bar{x}) = \begin{bmatrix} x_1 & x_2 & x_1 + x_2 \end{bmatrix}$$

$$g = \tanh$$

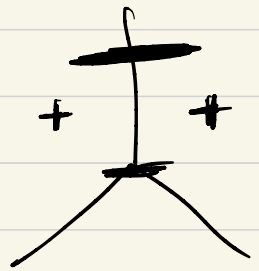
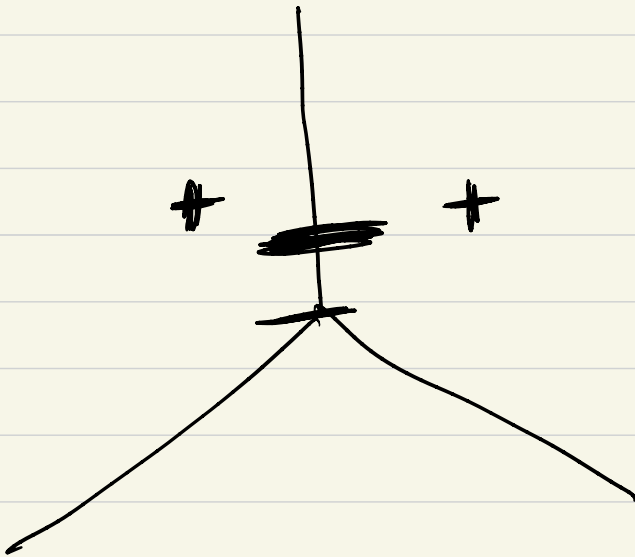
$$\bar{z} = \begin{bmatrix} \tanh(x_1) & \tanh(x_2) & \tanh(x_1 + x_2) \end{bmatrix}$$

$$\tanh(0) = 0$$

$$\tanh(1) \approx 0.7$$

$$\tanh(2) \approx 0.85$$

no nonlin



Classification

$$\overline{w}^T \overline{z} = \overline{w}^T g(\sqrt{f(\overline{x})})$$

This works (data is separable)