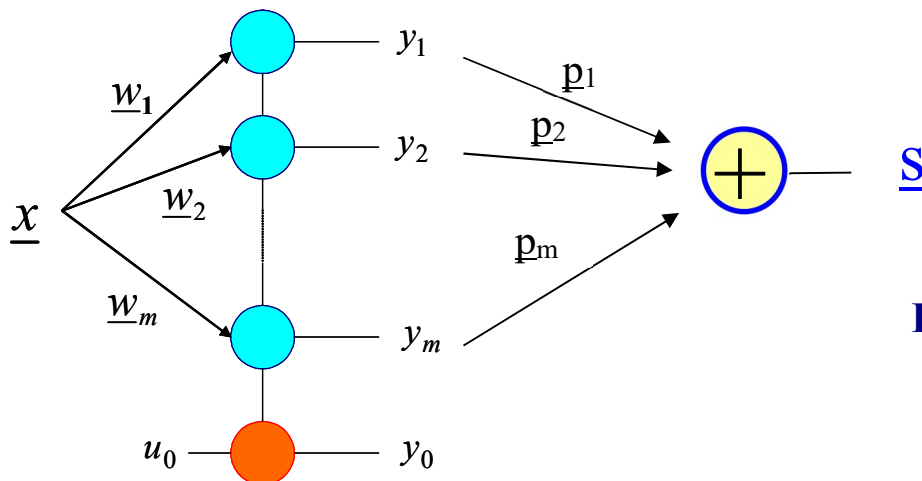


Counterpropagation (tipo feedforward)

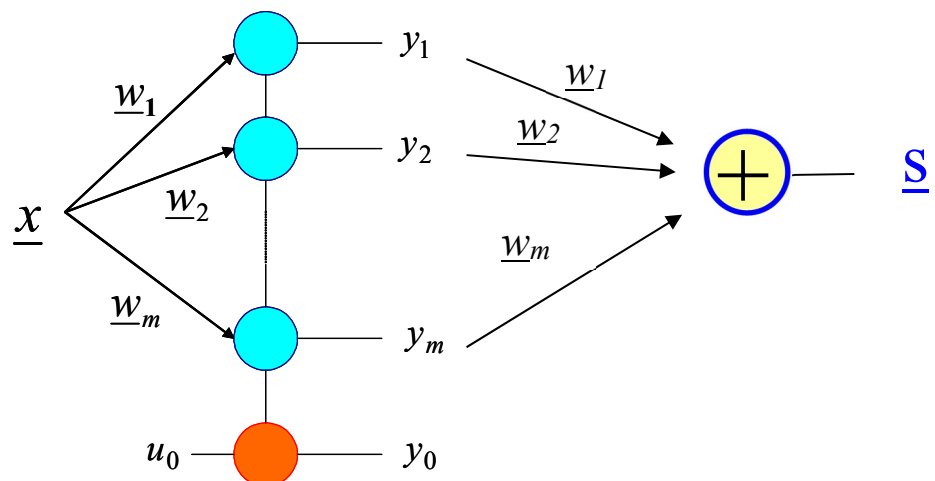


Robert Hecht-Nielsen
(cientista computação)

Memória hetero associativa

$$\underline{s} = \sum_{j=1}^m y_j \underline{p}_j \quad \underline{s} = \underline{p}_i \quad (y_i=1)$$

Se $\underline{p}_i = \underline{w}_i \quad \underline{x} = \underline{w}_i + \underline{r} \quad \Rightarrow \quad \underline{s} = \underline{w}_i$



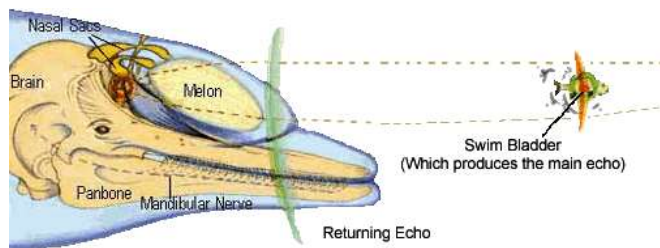
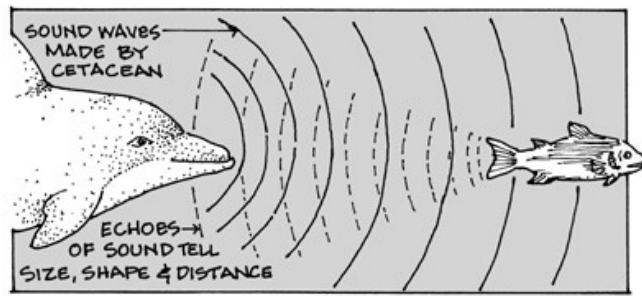
Memória auto associativa

Memória endereçável por conteúdo

Filtragem não linear

Deteção (e reprodução) de padrões desconhecidos

Ex 1: Dolphin Ecolocation



Time to frequency patterns:

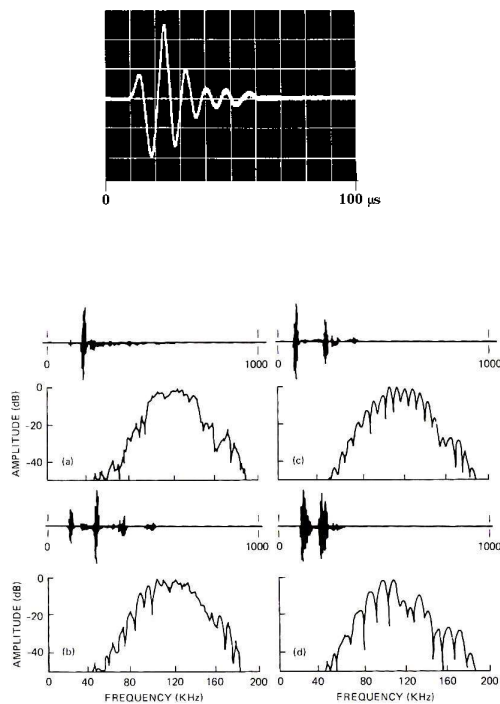
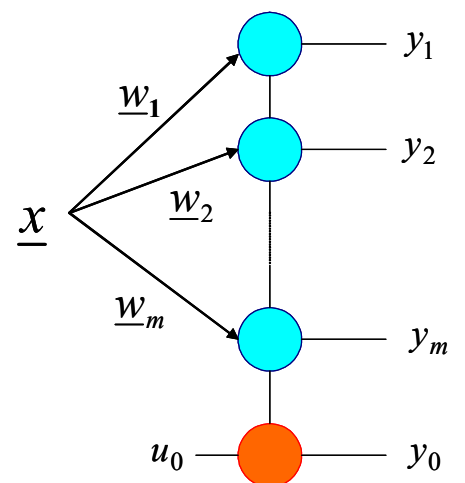
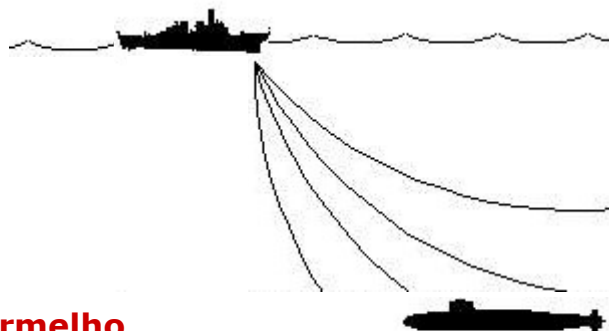


Figure 10-11. Amplitude display and Fourier transform for each item in the dolphin echolocation experiment. (From H. L. Roitblatt, et al. Dolphin Echolocation: Identification of returning echoes using a counterpropagation network. *Proc. IJCNN*. © 1989 IEEE.)



Ex 2: Sonar Passivo



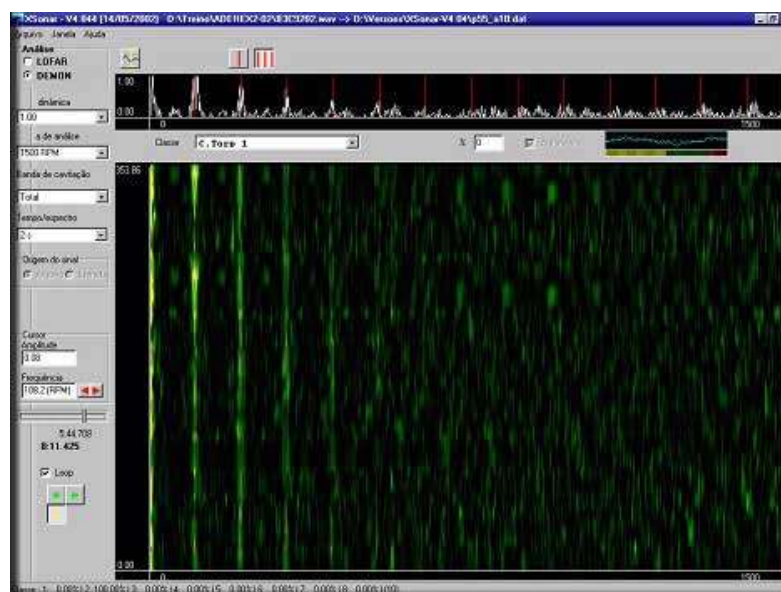
A Caçada Ao Outubro Vermelho

(The Hunt For Red October)



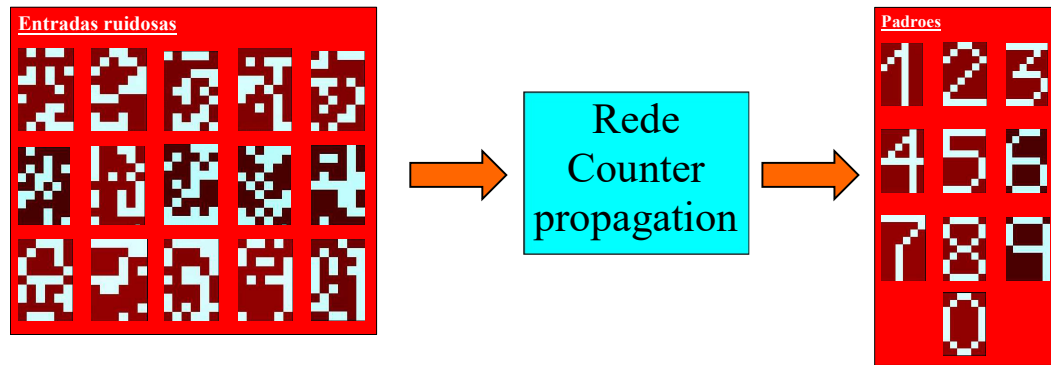
Classificador de Contatos Sonar (IPqM / UFRJ):

Classificação de alvos via análises Lowfar e Demon do ruído irradiado utilizando-se **reconhecimento de padrões através de redes neurais**.



Ex 3: OCR: Figuras com ruído

Obtenções de padrões a partir de sinais ruidosos:



Compressão de informações

Compressão de imagens

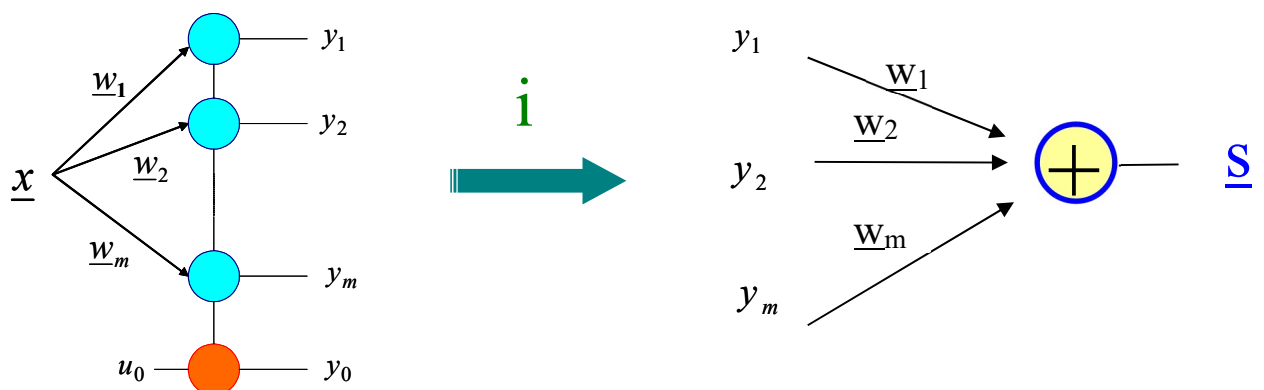
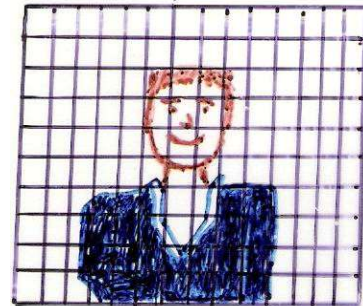


Imagem P&B

BMP

1 quadro 4x4 pix = 16 pix

16 pix/quadro 8 bits/pix = 128 bits/quadro

Compressao RN

1 quadro 4x4 pix

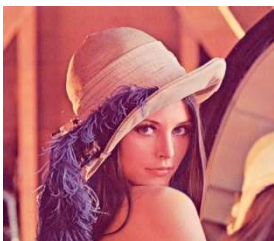
8 padroes/quadro 3 bits/padrao = 24 bits/quadro

Taxa de compressao: $128/24 = 5.3 \times$

Exemplo de Compressão

Imagens original e comprimidas

(1x)



(11x)



(15x)



(28x)



Efeito do codebook (compressão aprox 20x)

codebook Lena



codebook house

