



Redes neurais

Jones Granatyr

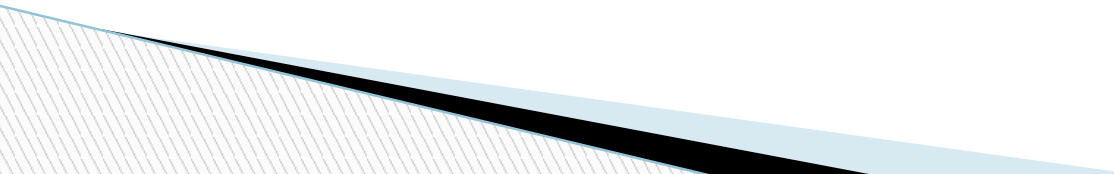
Contexto

- ❑ Problemas que são resolvidos por algoritmos pré-determinados (sistemas de recomendação, buscas, grafos, ordenações)
- ❑ Algoritmo pré-definido para reconhecimento facial?
Processamento de linguagem natural?
- ❑ Algumas aplicações
 - Descoberta de novos remédios
 - Entendimento de linguagem natural
 - Carros autônomos
 - Reconhecimento facial
 - Cura para doenças
 - Bolsa de valores
 - Encontrar soluções para controle de tráfego
- ❑ Muitos dados e problemas complexos

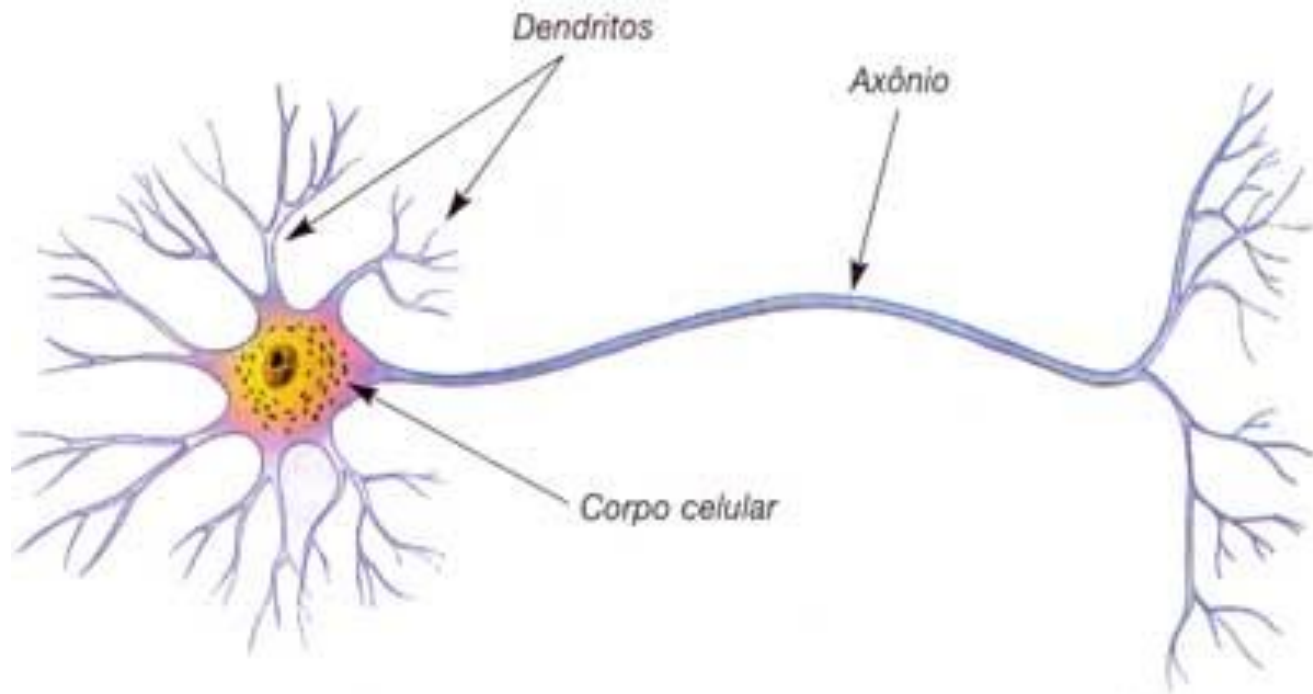
Redes neurais



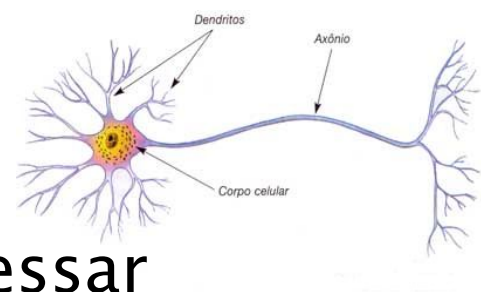
Redes neurais

- ❑ Imitar o sistema nervoso de humanos no processo de aprendizagem
 - ❑ Inspirada em redes neurais biológicas
 - ❑ Parecido com a troca de informações em uma rede biológica
 - ❑ Com deep learning (aprendizagem profunda) as redes neurais ficaram populares novamente
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Neurônio



Neurônio



- ❑ **Neurônios:** o cérebro usa para processar informações
- ❑ **Axônio:** transmite o sinal de um neurônio para outro (sinais elétricos, sinapses) – conecta os neurônios
- ❑ Substâncias químicas são lançadas das sinapses e entram pelos dendritos, aumentando ou baixando o potencial elétrico do corpo da célula
- ❑ O neurônio dispara se a entrada é maior que um número definido (liga ou não liga)

Redes neurais

- ❑ Fornece um valor de entrada, a rede processa e retorna uma resposta
- ❑ O neurônio é ativado somente se o valor for maior que um limiar

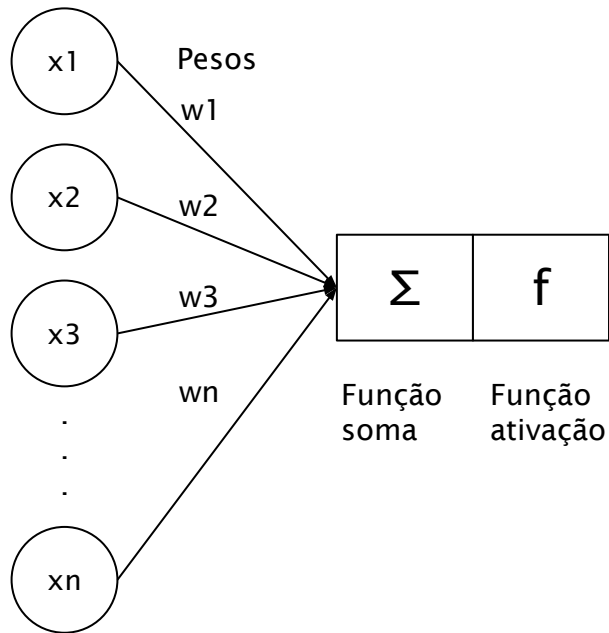
Entrada

Neurônios e
axônios

Saída

Neurônio artificial

Entradas



1943 - McCulloch e Pitts

1958 - Frank Rosenblatt (perceptron)

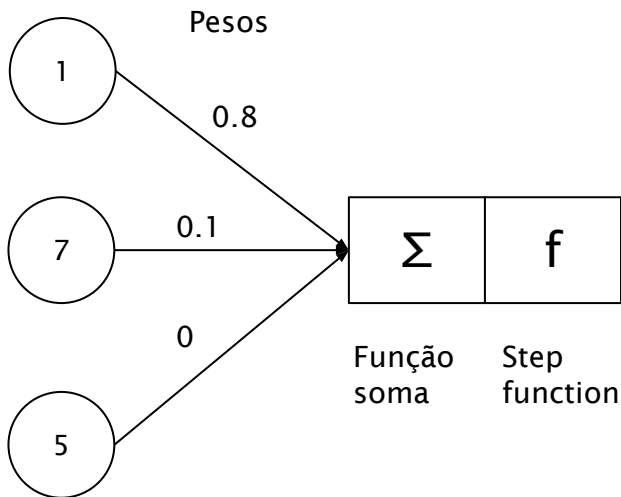
$$soma = \sum_{i=1}^n x_i * w_i$$

Neurônio artificial

$$soma = \sum_{i=1}^n x_i * w_i$$

$$soma = (1 * 0.8) + (7 * 0.1) + (5 * 0)$$

Entradas



Step function (função Degrau)

Maior do que zero = 1

Caso contrário = 0

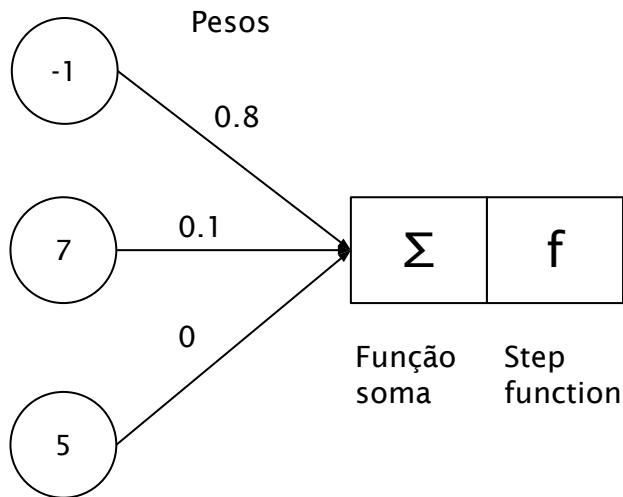
Representação tudo ou nada

Neurônio artificial

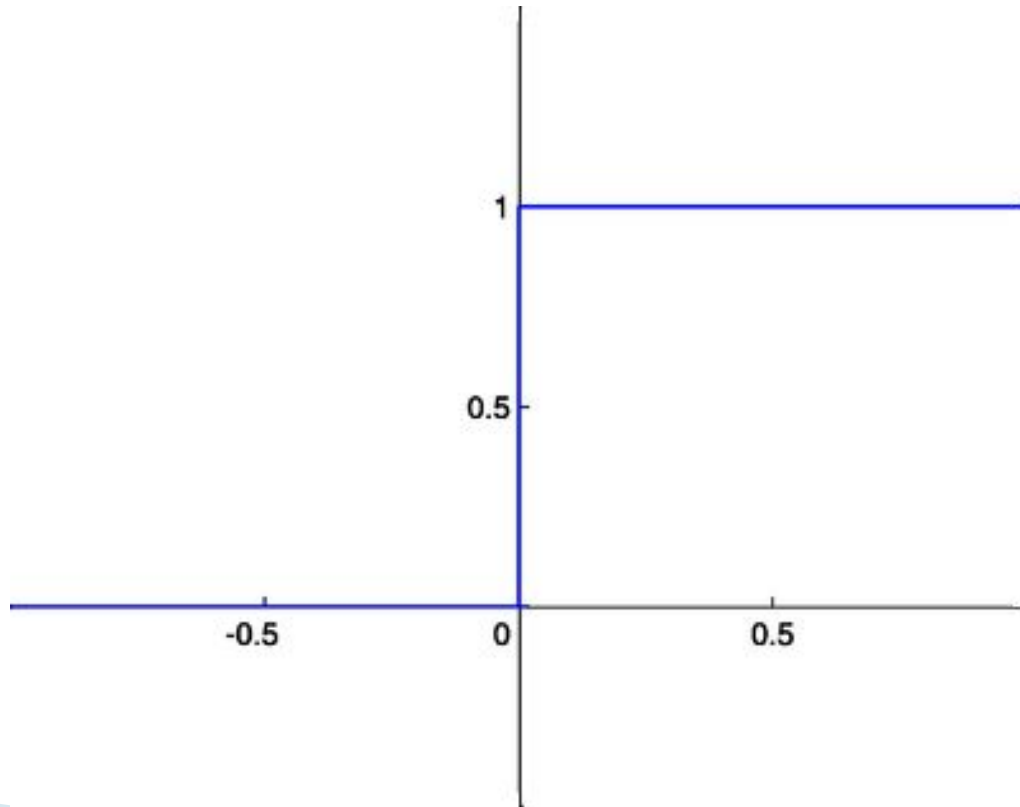
$$soma = \sum_{i=1}^n x_i * w_i$$

$$soma = (-1 * 0.8) + (7 * 0.1) + (5 * 0)$$

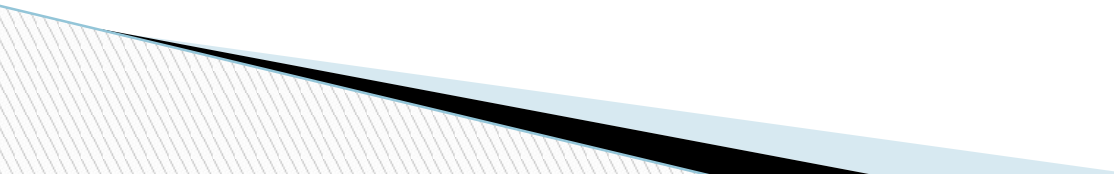
Entradas



Step function



Redes neurais

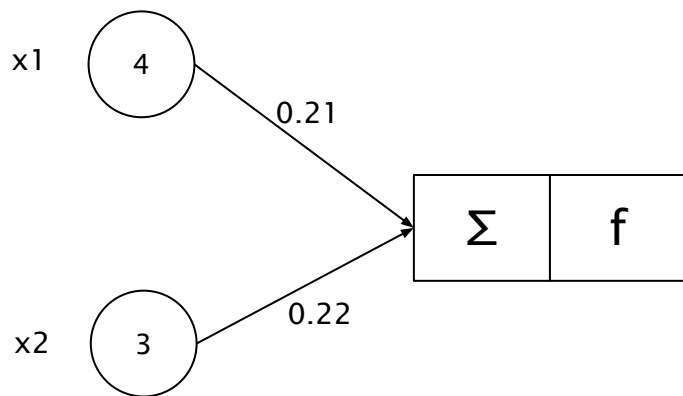
- Peso positivo - sinapse excitadora
 - Peso negativo - sinapse inibidora
 - Pesos são sinapses
 - Pesos amplificam ou reduzem o sinal de entrada
 - Conhecimento da rede neural são os pesos
- 

Classificação

x1 - comprimento do parafuso

x2 - diâmetro do parafuso

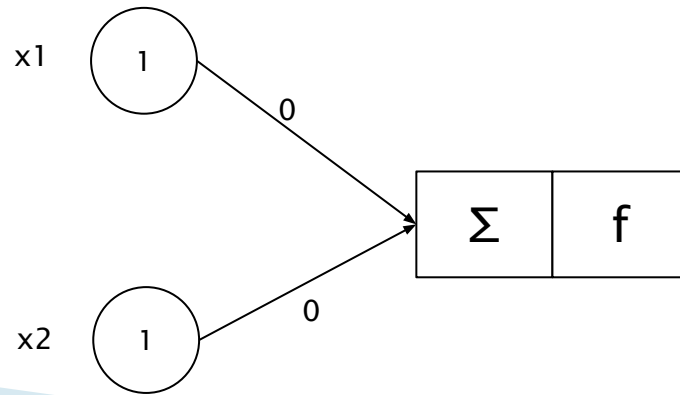
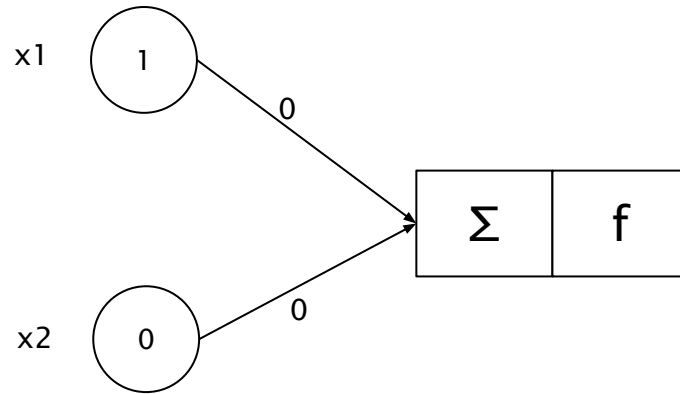
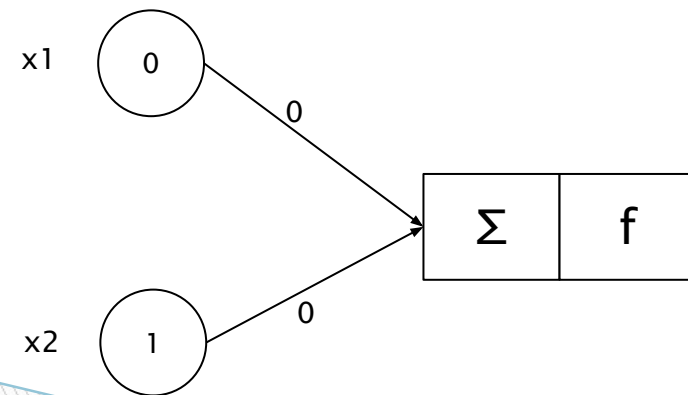
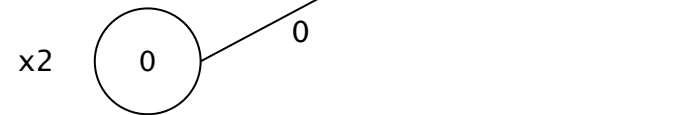
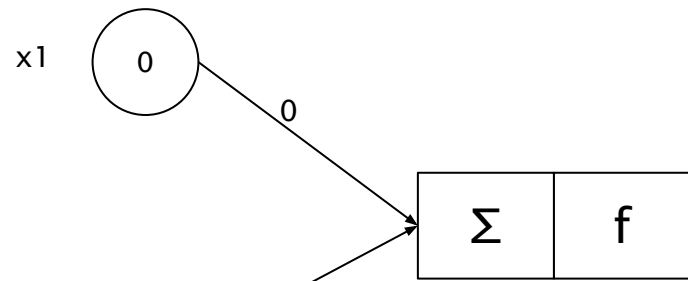
Classe A (0) e Classe B (1)



$$soma = \sum_{i=0}^n x_i * w_i$$

Operador E

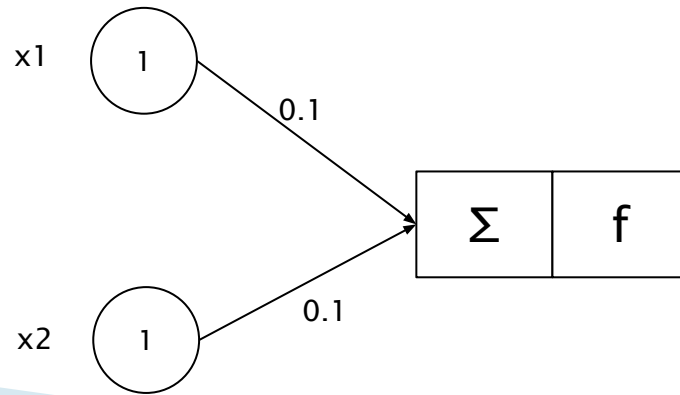
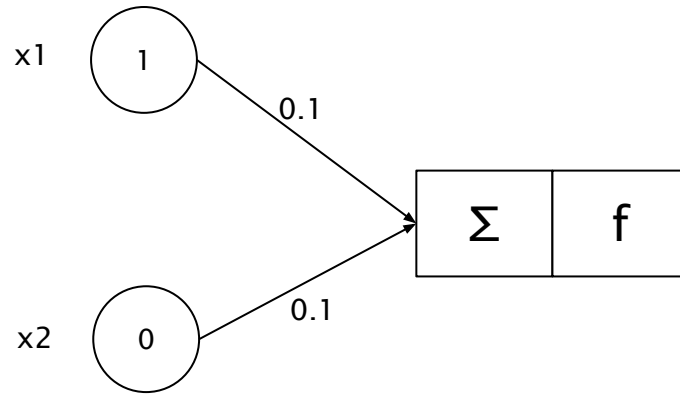
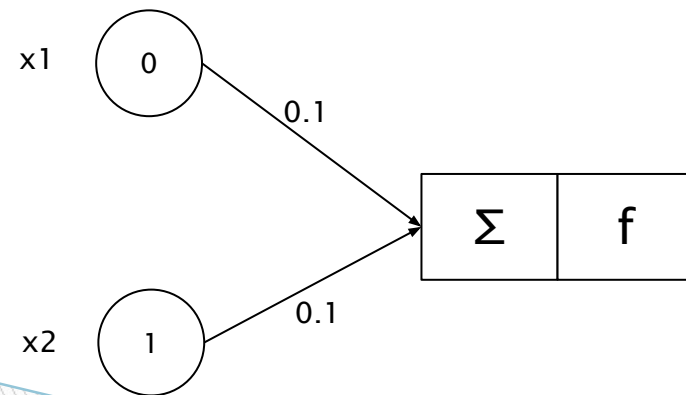
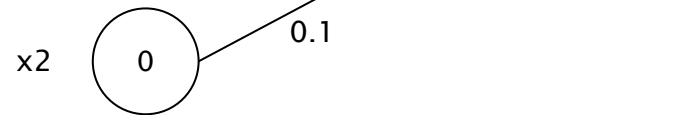
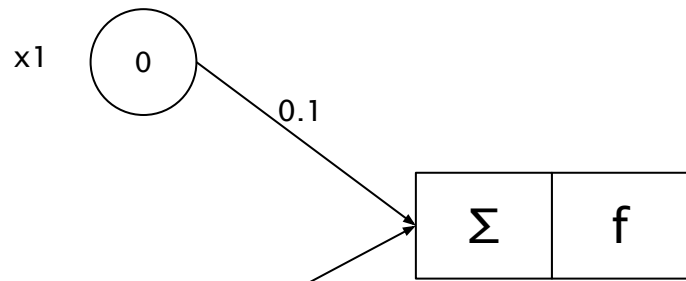
x1	x2	Classe
0	0	0
0	1	0
1	0	0
1	1	1



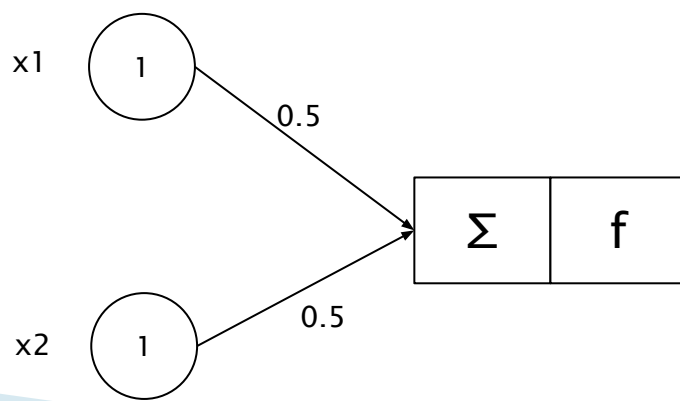
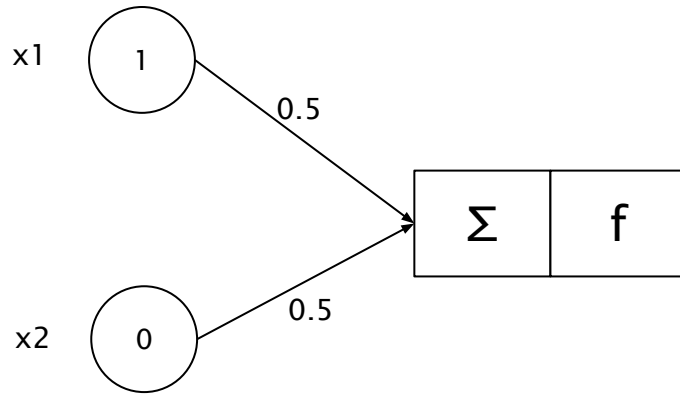
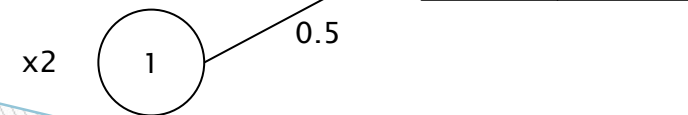
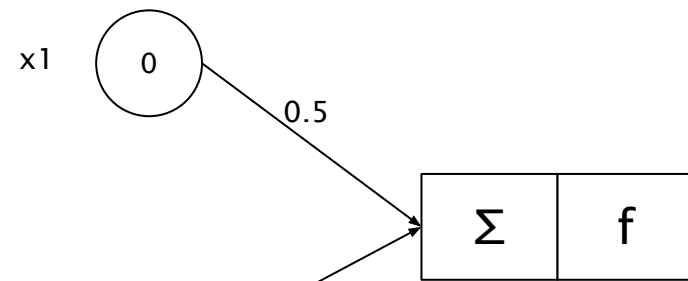
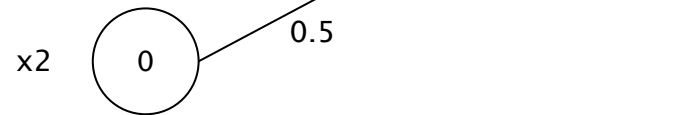
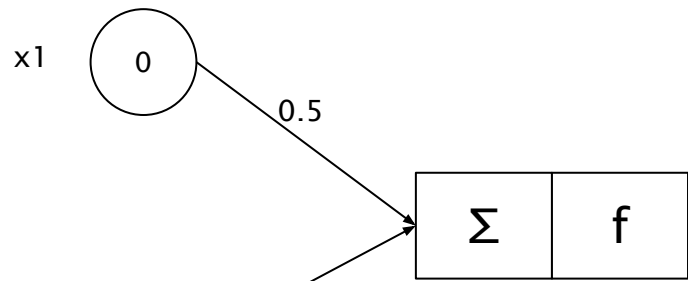
x1	x2	Classe
0	0	0
0	1	0
1	0	0
1	1	1

Erro

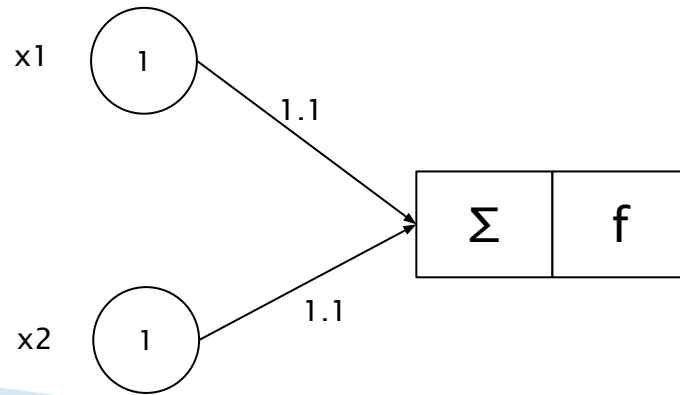
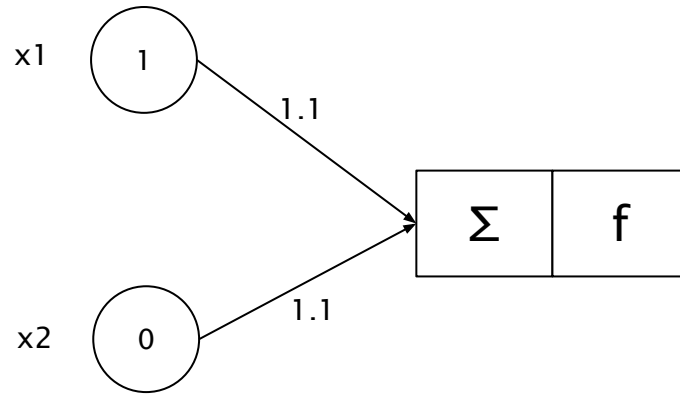
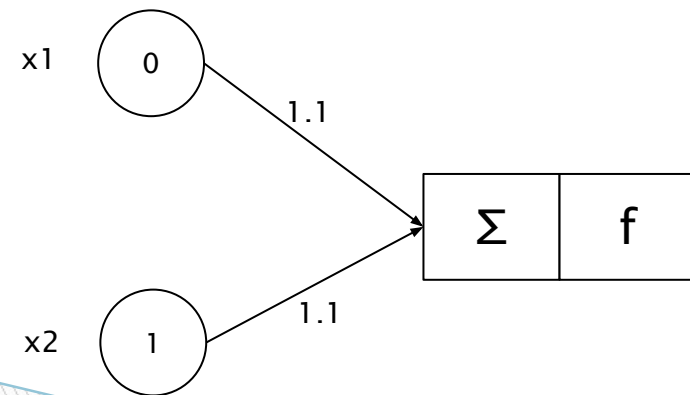
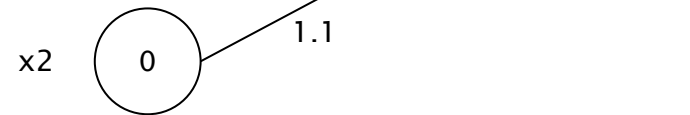
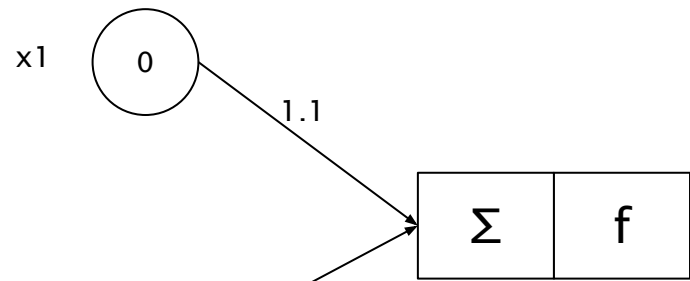
- ❑ Algoritmo mais simples
 - $\text{erro} = \text{respostaCorreta} - \text{respostaCalculada}$
- ❑ Os pesos são atualizados até os erros serem pequenos
 - $\text{peso}(n + 1) = \text{peso}(n) + (\text{taxaAprendizagem} * \text{entrada} * \text{erro})$



x1	x2	Classe
0	0	0
0	1	0
1	0	0
1	1	1



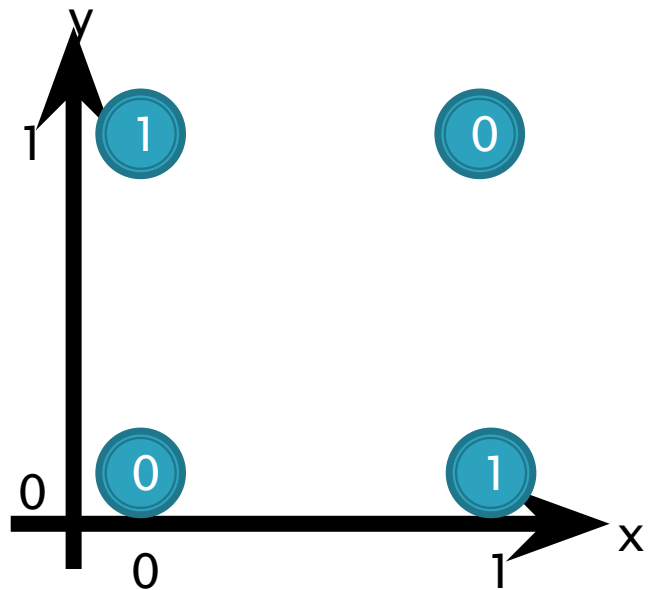
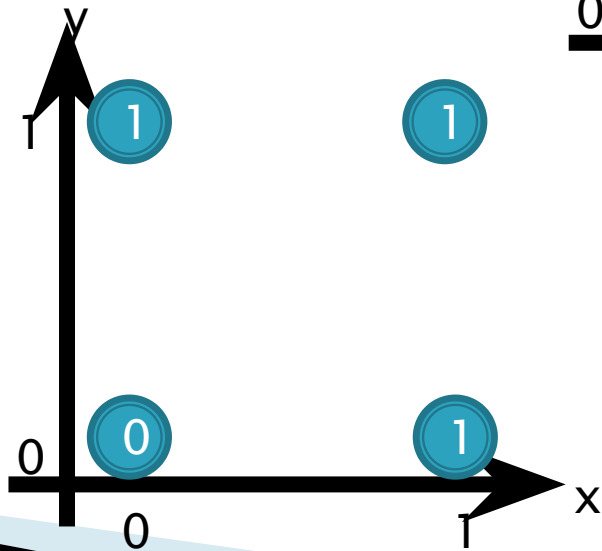
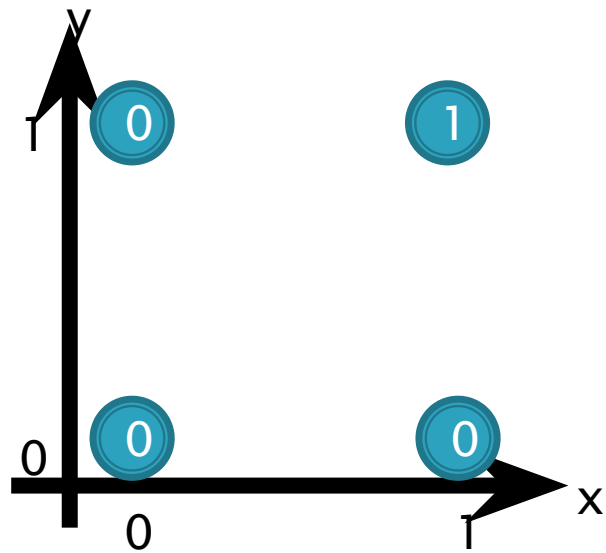
x1	x2	Classe
0	0	0
0	1	0
1	0	0
1	1	1



x1	x2	Classe
0	0	0
0	1	1
1	0	1
1	1	1

Algoritmo

- Enquanto o erro for diferente de zero
 - Para cada registro
 - Calcula a saída com os pesos atuais
 - Compara a saída esperada com a saída calculada, somando o erro
 - Para cada peso da rede
 - Atualiza o peso - $\text{peso}(n + 1) = \text{peso}(n) + (\text{taxaAprendizagem} * \text{entrada} * \text{erro})$



Conclusão

