

Quarto Capítulo

Redes de Neurónios



idefe

A Ideia Subjacente às Redes de Neurónios

- Hephaestus tem robôs dourados com a aparência de senhoras vivas, com inteligência nos seus corações, com fala, e com força proveniente dos deuses imortais que lhes ensinaram como realizar tarefas.

(Ilíada de Homero)

O que Sabemos sobre o Cérebro

- 600 BC: Os filósofos gregos acreditavam que o cérebro tinha espírito
- Descartes (1637): O cérebro é uma máquina
- Galvani (1791): O cérebro tem electricidade
- Gogli (1837): Nefrites e dendrites
- Cajal (1888): Neurónios como células
- Hodgkin e Huxley (1950s): Modelo de comunicação eléctrica do cérebro a nível celular

Comparação entre Redes Biológicas e Redes Artificiais

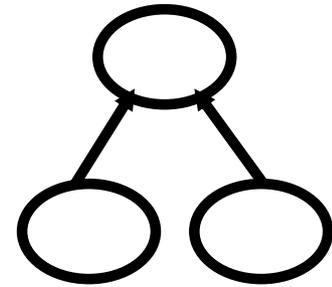
• Biológicas

- Célula
- Dendrite
- Nefrite
- Sinapse
- Velocidade lenta
- Muitos neurónios
- Operações complexas por neurónio



• Artificiais

- Nó
- Input
- Output
- Peso
- Velocidade rápida
- Poucos nós
- Operações simples por nó

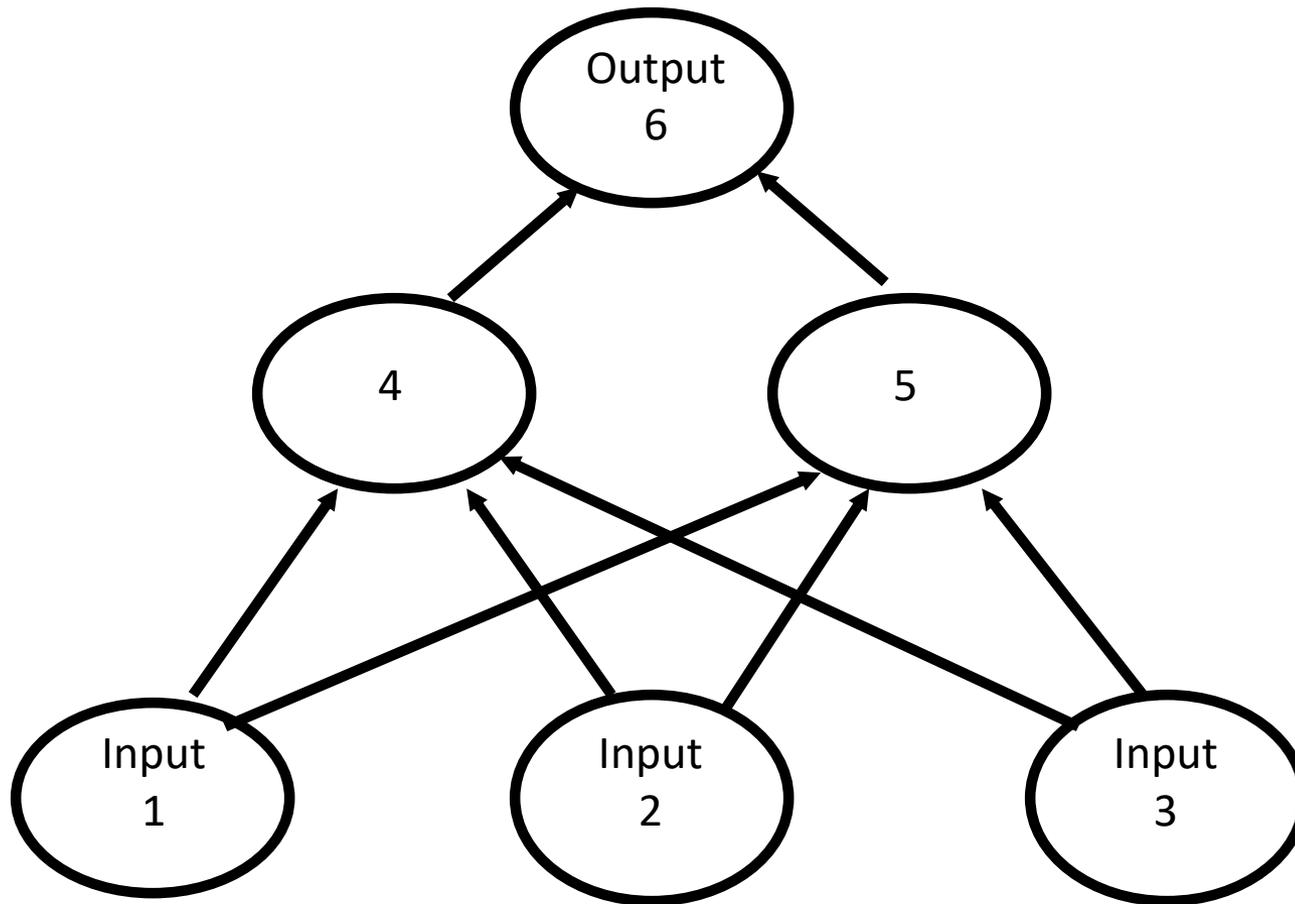




Arquitectura das Redes de Neurónios (1/2)

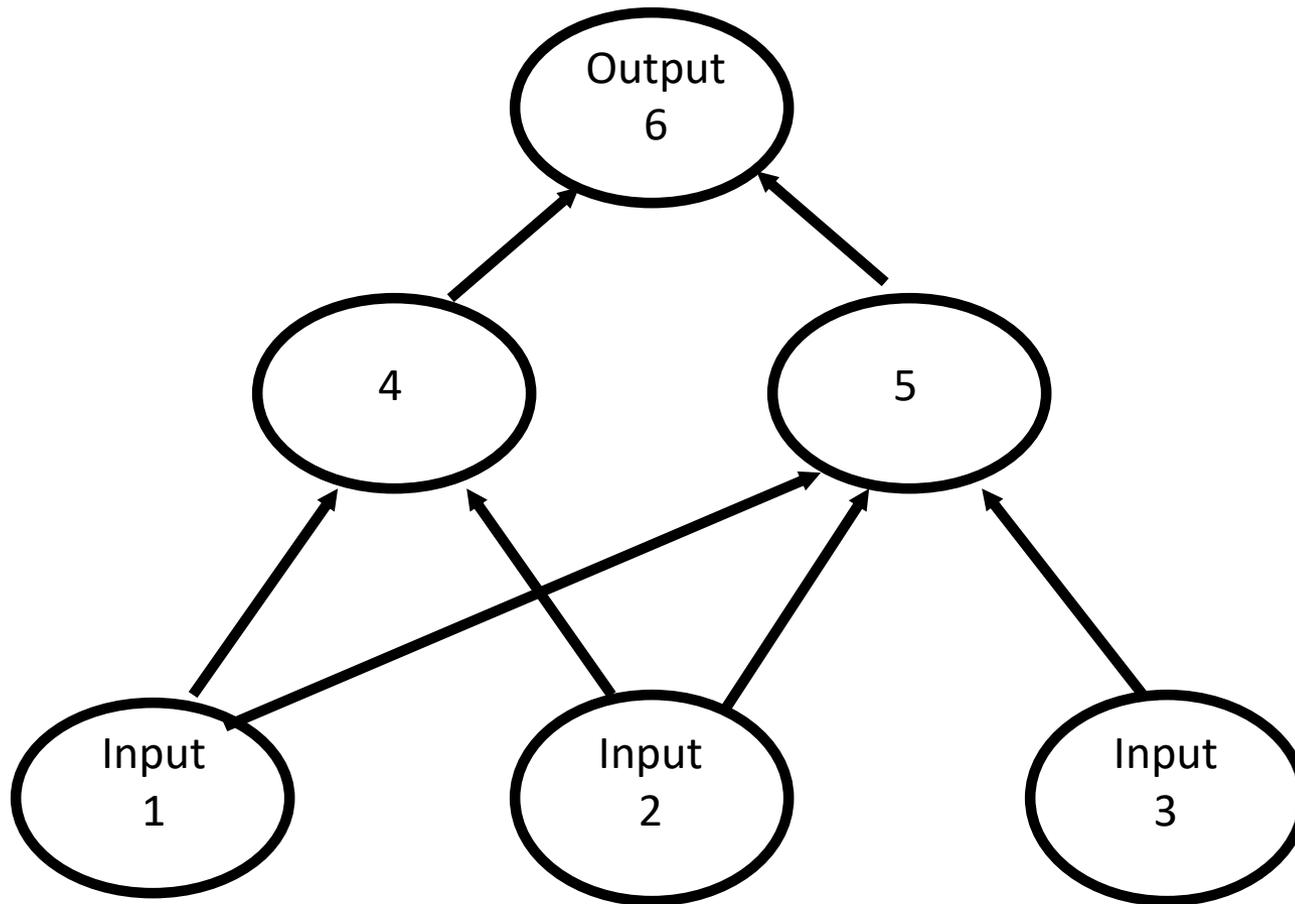
- Níveis ou linhas
- Conectividade
- Input
- Processamento
- Output/ Resultado
- Aprendizagem

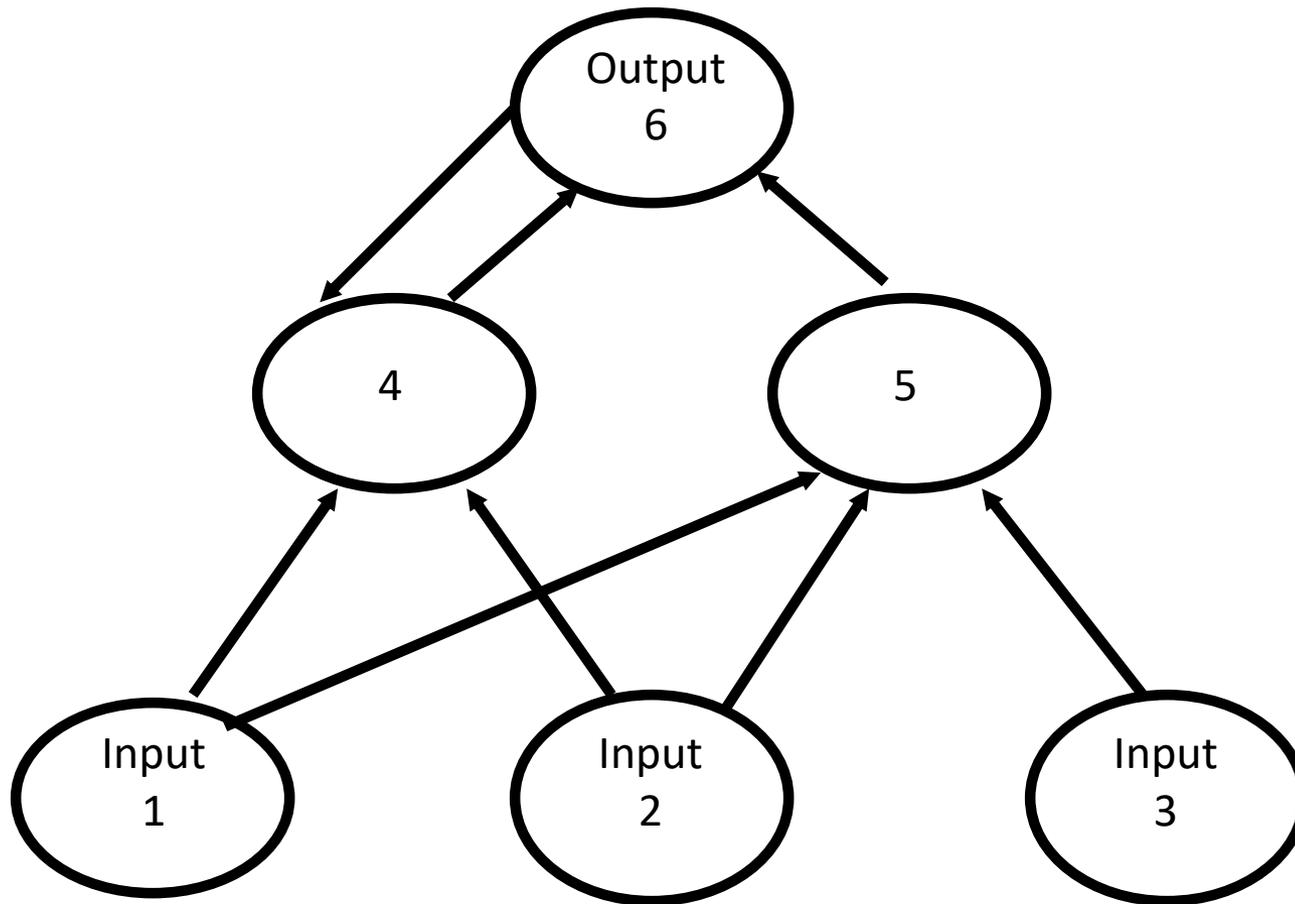
(Conectividade completa, Feed Forward e hierárquica)

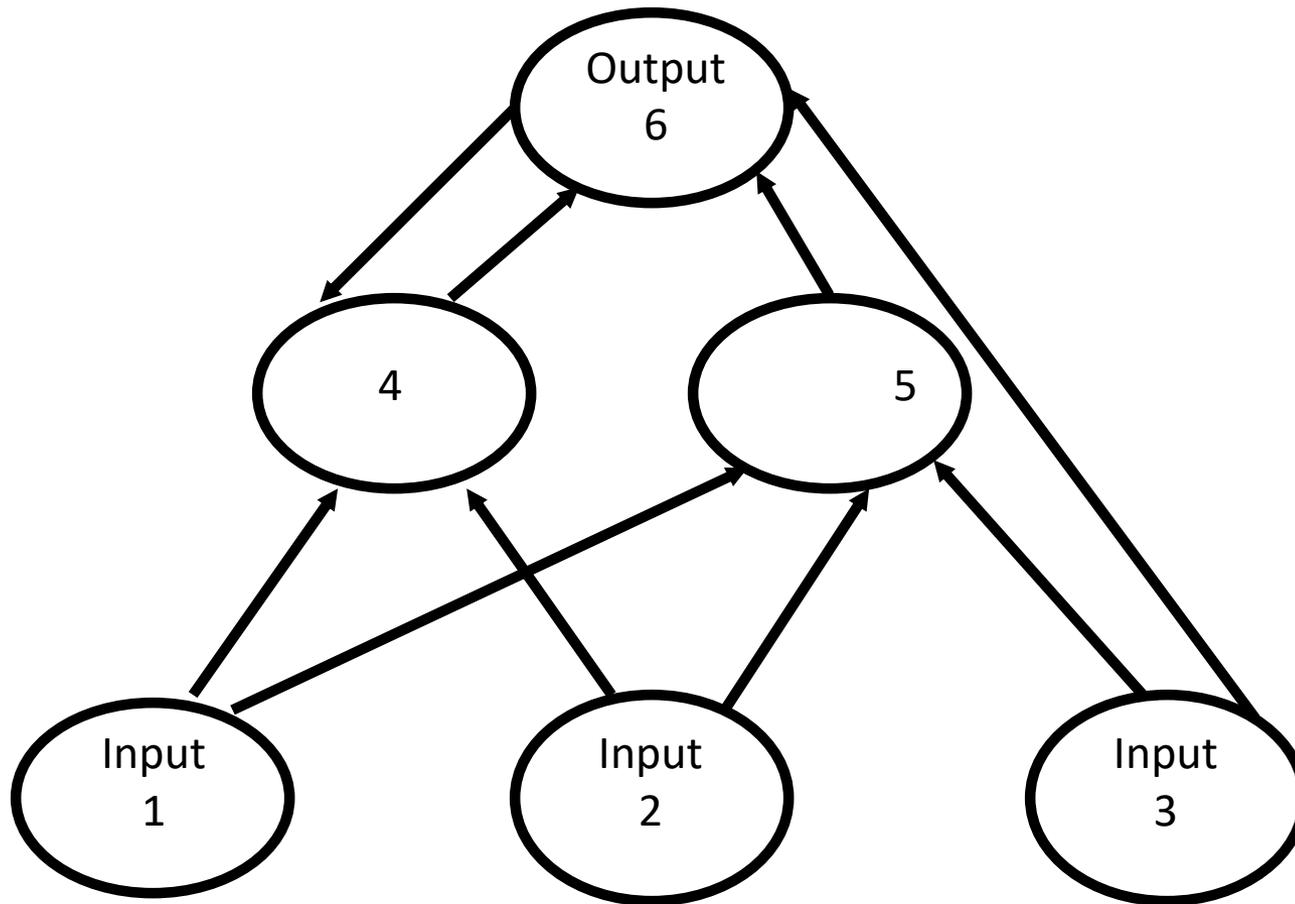


Conectividade

- Inter-nível
 - Conectividade completa ou parcial
 - “Feed forward” ou bi-direccional
 - Hierárquica
- Intra-nível (por vezes)
 - Recorrente
 - Para o centro

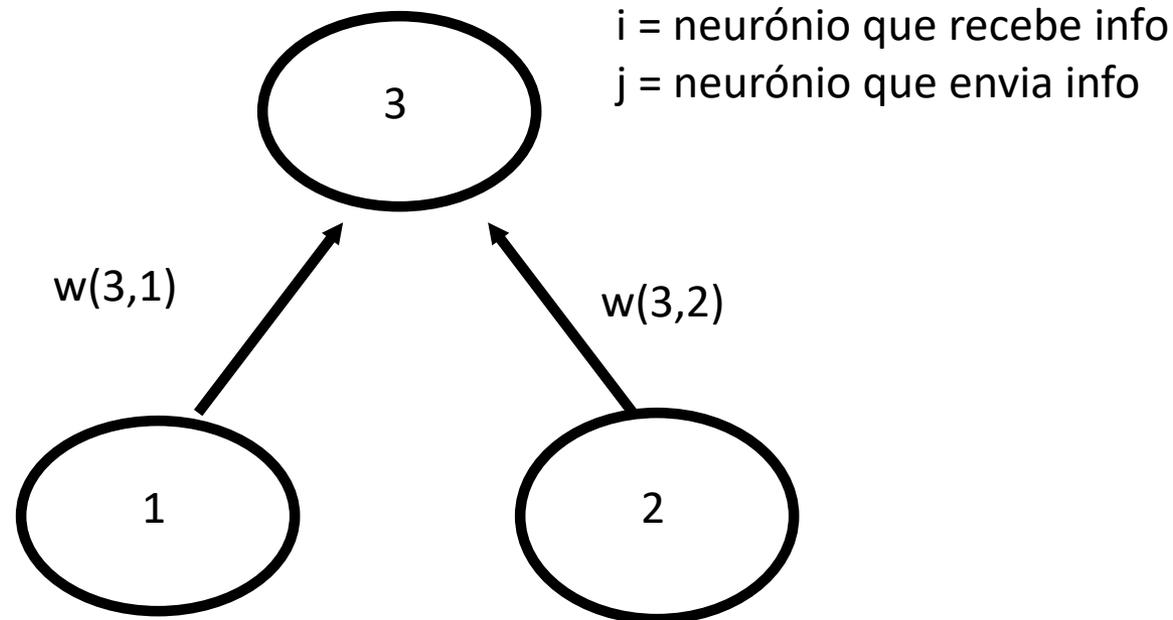






Input

- Ponderação de inputs [$w(i,j)$]
- $\text{input}(i) = \sum w(i,j) \cdot \text{Output}(j)$

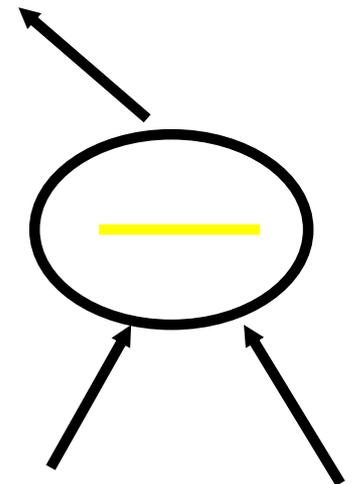
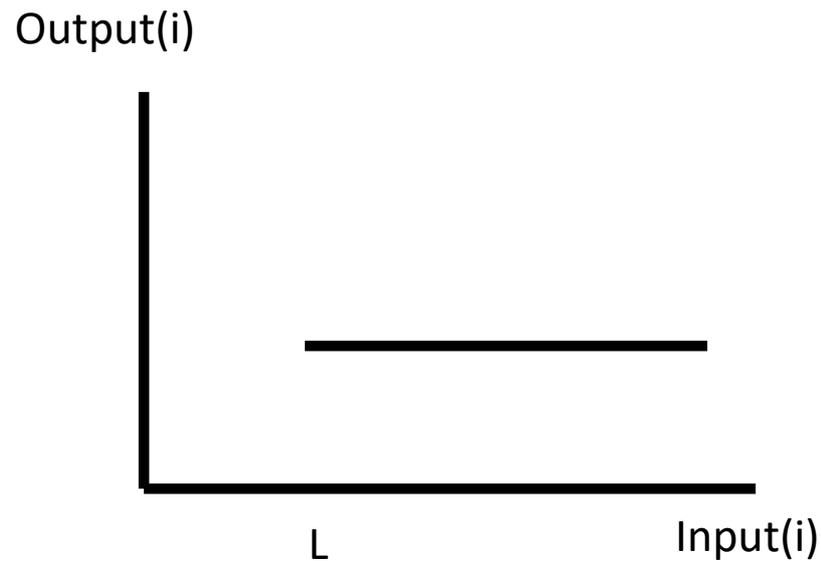


Função de Transferência e Respectivo Output

- Uniforme
- Uniforme desde a origem
- Sigmoide (em s)
- Linear
- Linear desde a origem

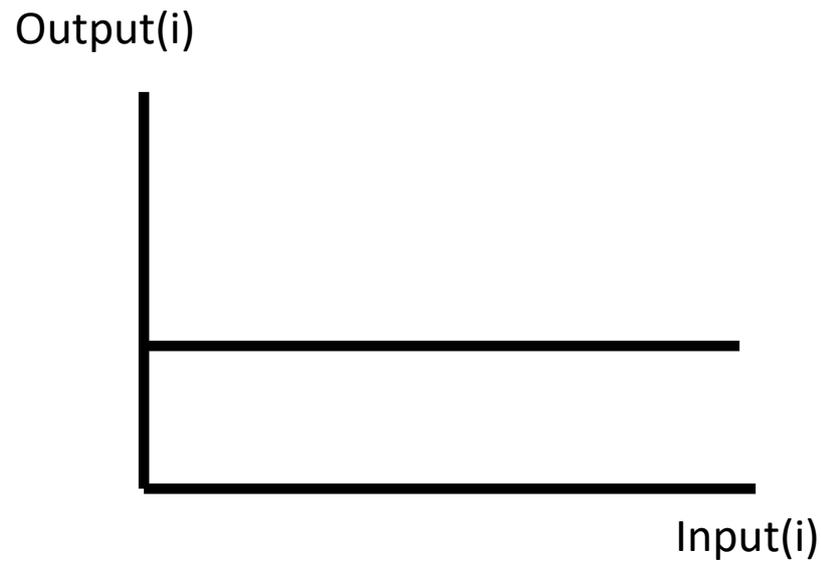
Função de Transferência Uniforme

- $\text{Output}(i) = 0$, se $\text{input}(i) \leq L$
- $\text{Output}(i) = 1$, se $\text{input}(i) > L$



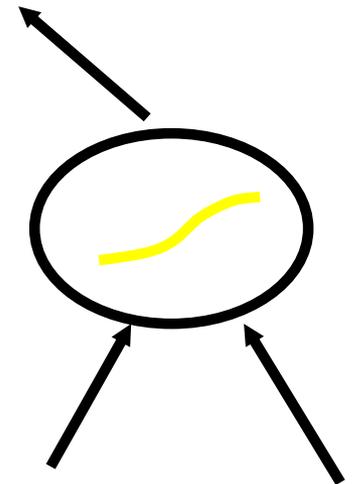
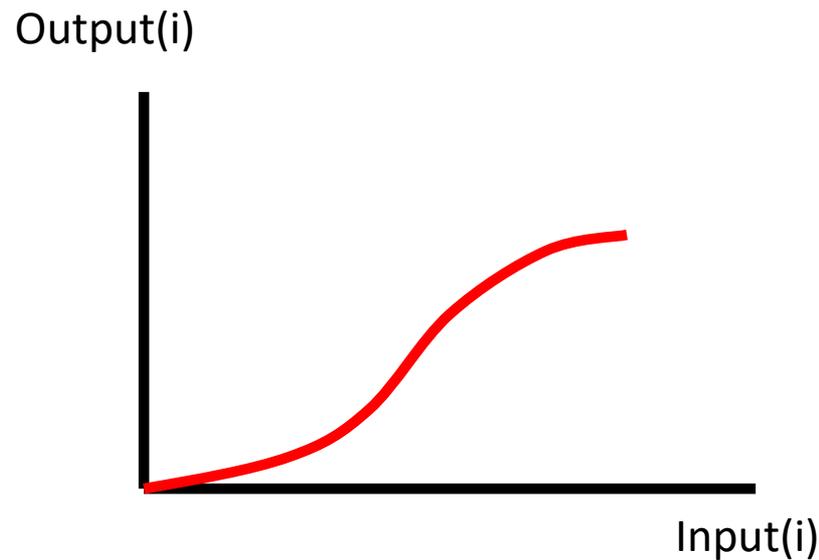
Função de Transferência Uniforme Desde a Origem

- $\text{Output}(i) = 1$



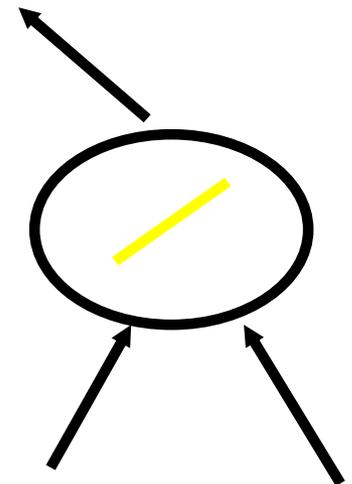
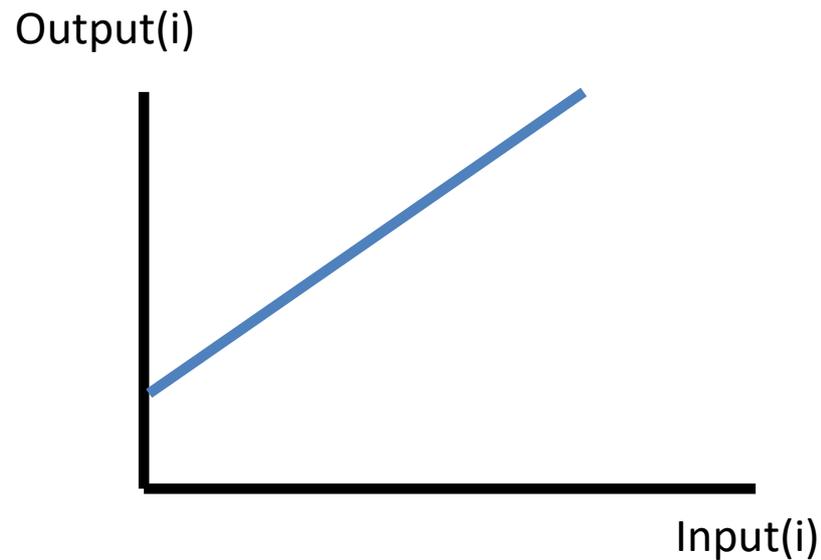
Função de Transferência Sigmoidal (em s)

- $Output(i) = 1 / [1 + e^{(-ganho \cdot Input(i))}]$



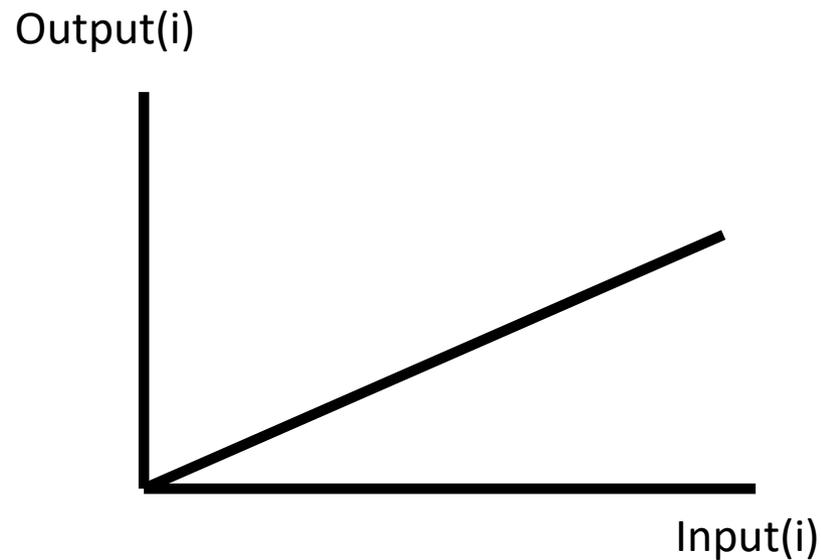
Função de Transferência Linear

- $Y = aX + b$
- $\text{Output}(i) = \text{ganho} \cdot \text{input}(i) + B$



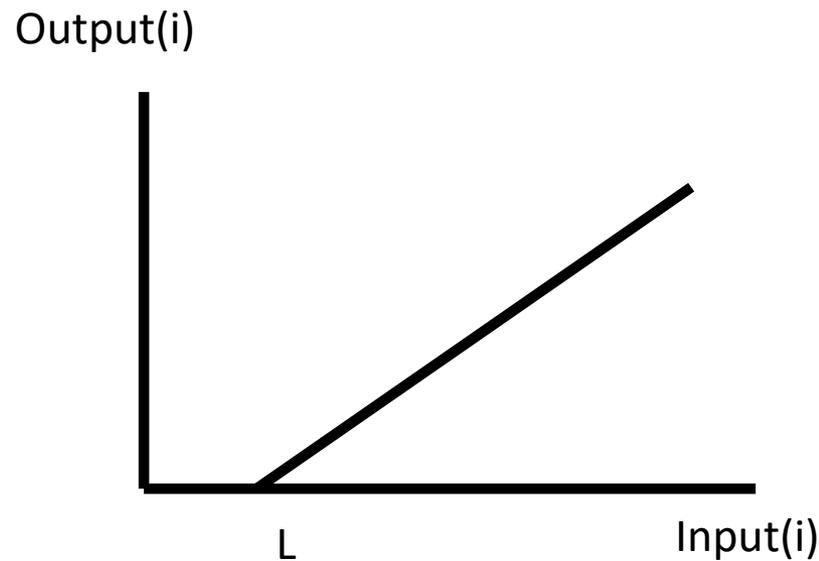
Função de Transferência Linear Desde a Origem

- $\text{Output}(i) = \text{ganho} \cdot \text{input}(i)$



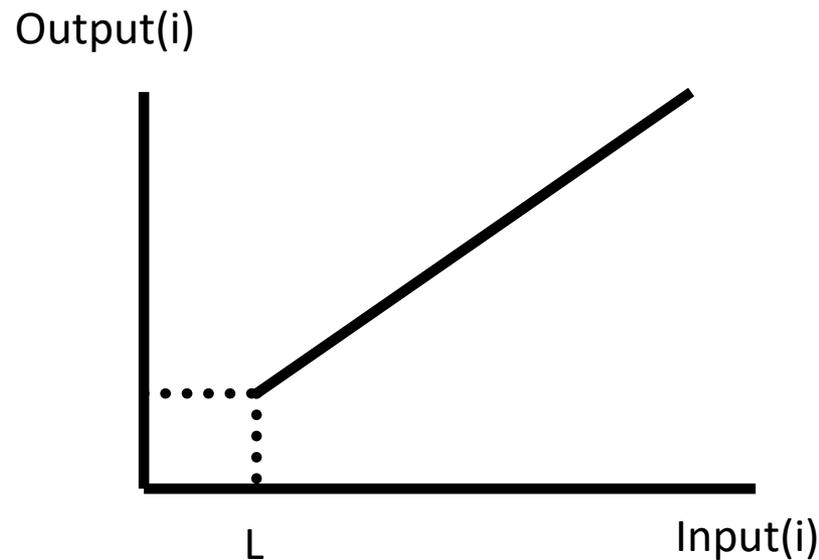
Função de Transferência Linear Desde L (1)

- $\text{Output}(i) = 0$, se $\text{input}(i) \leq L$
- $\text{Output}(i) = \text{ganho} \cdot \text{input}(i-L)$, se $\text{input}(i) > L$



Função de Transferência Linear Desde L (2)

- $\text{Output}(i) = 0$, se $\text{input}(i) \leq L$
- $\text{Output}(i) = \text{ganho} \cdot \text{input}(i)$, se $\text{input}(i) > L$



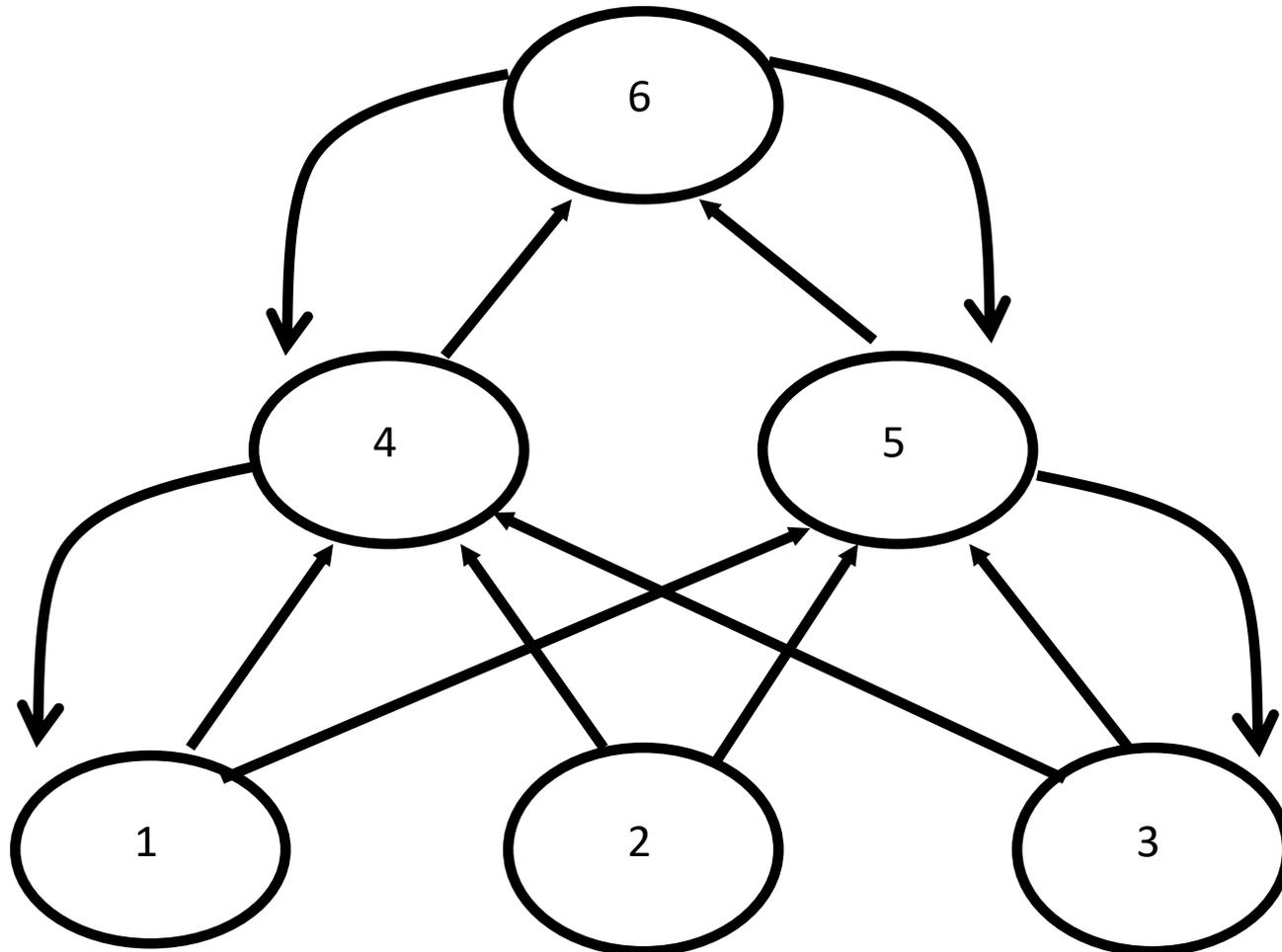
Obtenção da Informação para o Treino da NN

- Identificação dos “inputs” relevantes
- Lista de “inputs” e resultado final desejado
 - Normalmente, são necessárias muitas observações
 - Séries de treino com variações geram melhores resultados
- O objectivo da aprendizagem é minimizar o erro de decisão do nó final. Várias teorias e vários conceitos de erro resultam em várias regras de aprendizagem.

Processo de Treino

- Estático versus dinâmico
 - O ajustamento dos erros pode ser efectuado de um nó da rede para outros (estático) ou pode envolver ajustamentos em “rounds” múltiplos.
- Batch versus on-line
 - O treino pode ser efectuado através de um processo batch ou no momento de introdução dos dados. O treino on-line permite que a rede possa ser constantemente ajustada

Propagação de Erros (Desvios) no Treino: Backpropagation



Exemplos de Utilizações de Redes de Neurónios

- Previsão de falências por bancos;
- Previsão de cumprimento ou incumprimento de obrigações;
- Reconhecimento de caracteres;
- Reconhecimento de imagens;
- Reconhecimento de padrões de séries, valor de activos, por exemplo.

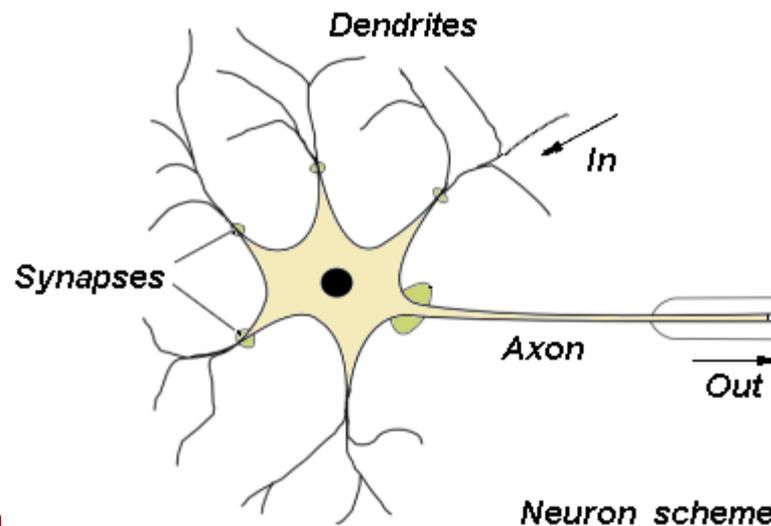
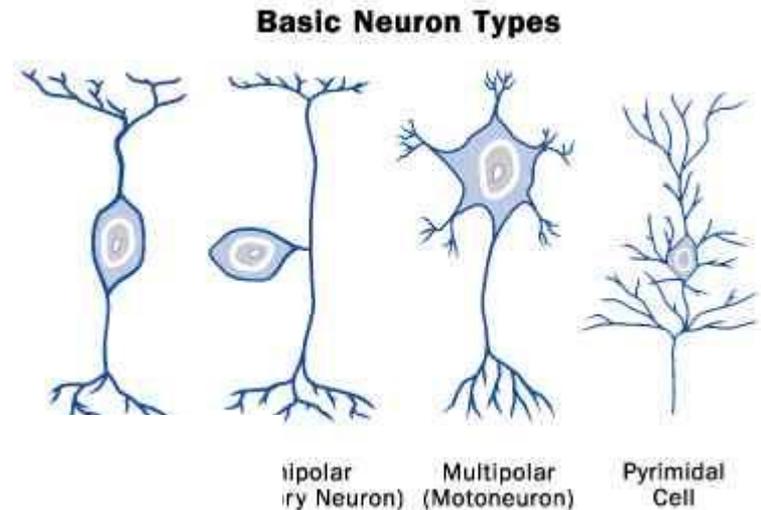
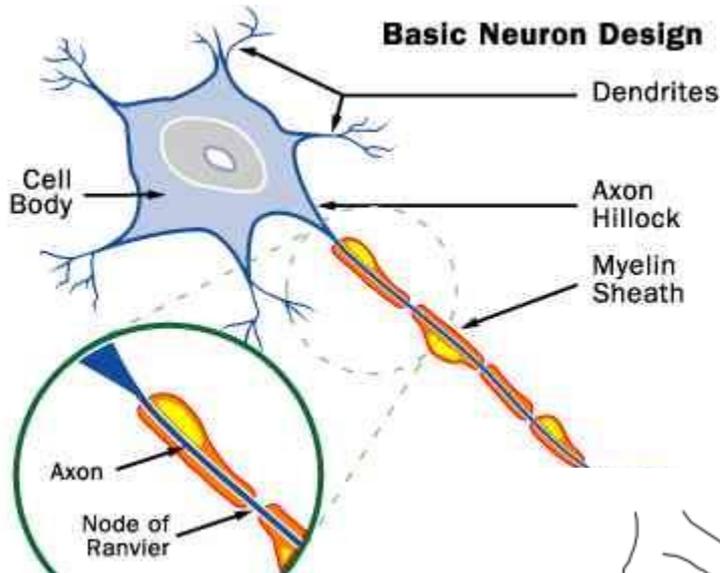
Conclusão da Matéria Sobre ES

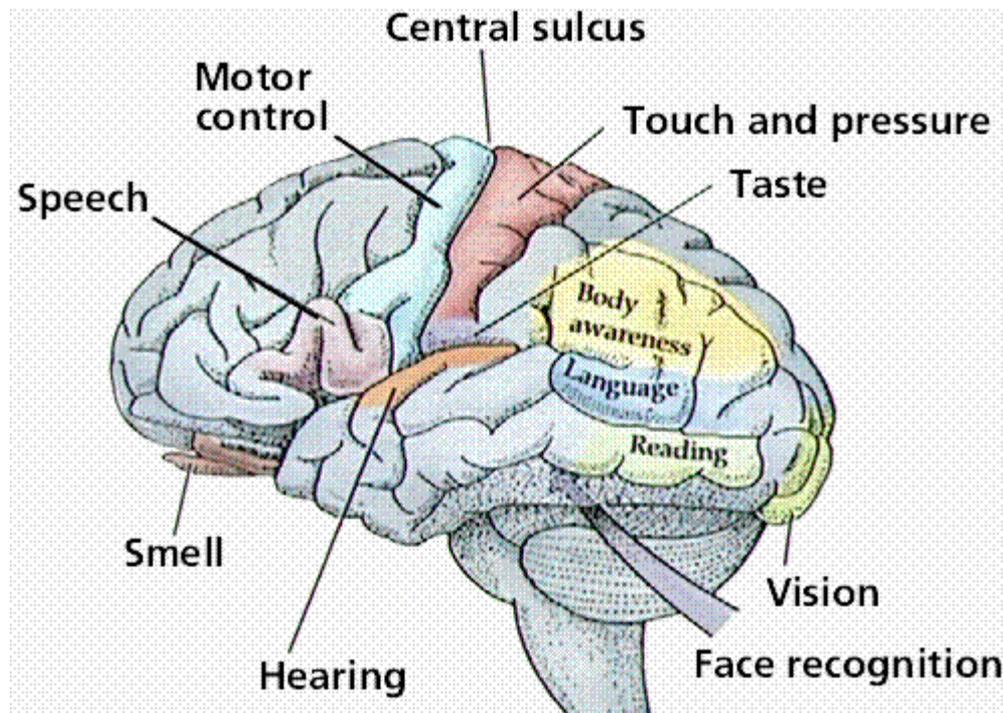
- Apresentação de NNs
- Apresentação e Discussão de Artigos e Casos sobre NNs
- A utilização de NNs (Discussão)

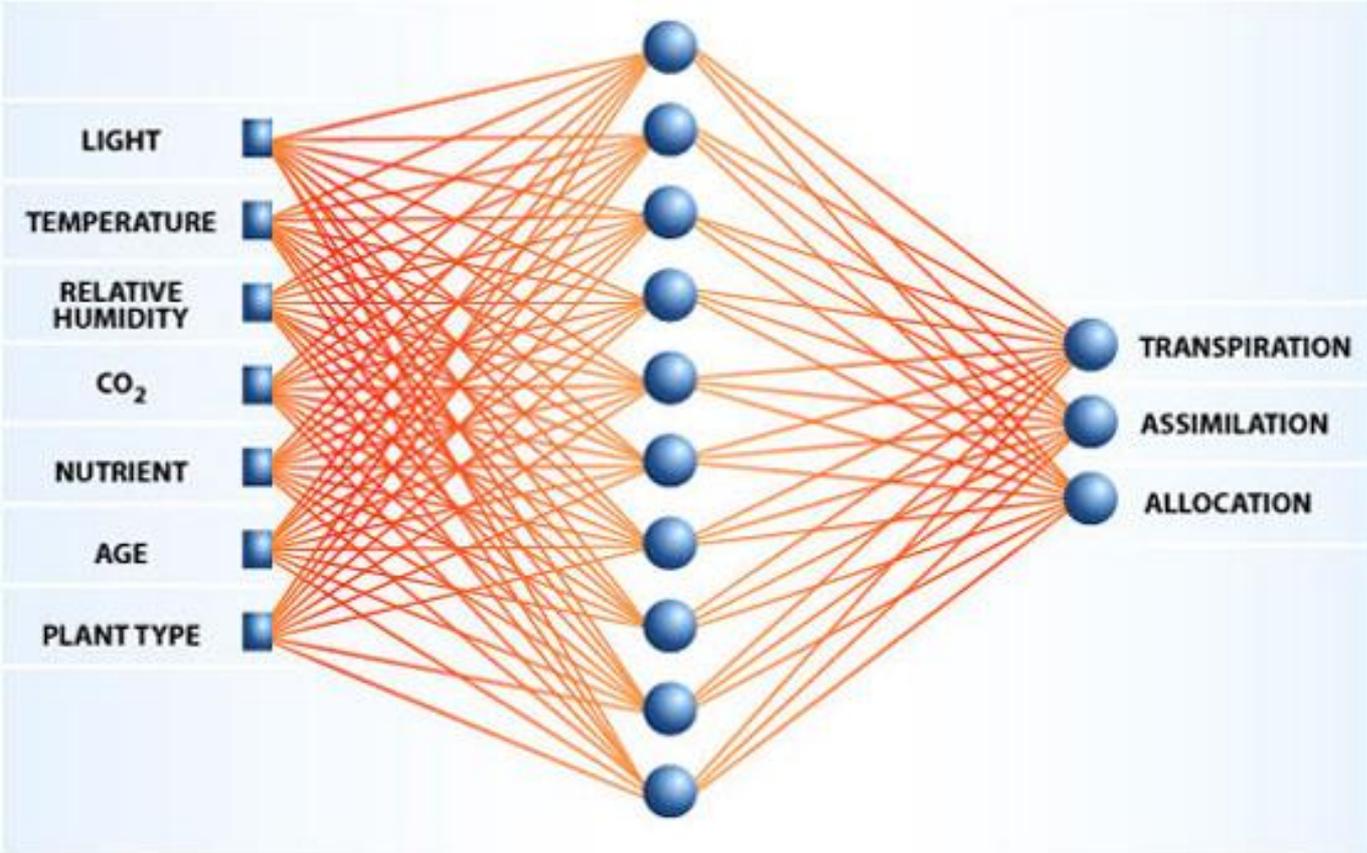
Questões sobre a aplicabilidade de NNs

- Quais os pressupostos para a aplicabilidade dos NNs?
- Que funções ou áreas da organização podem beneficiar de NNs? Como?
- Quais as dificuldades ou riscos de desenvolvimento, implementação e uso de NNs?

O cérebro humano

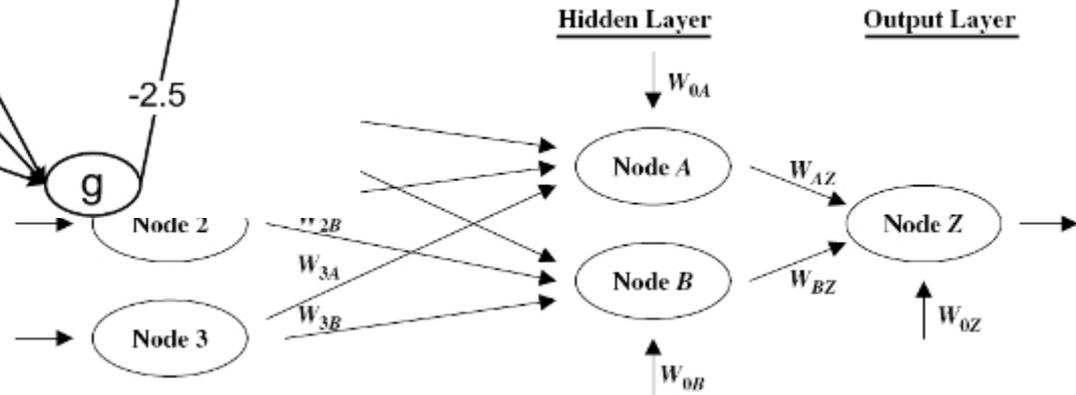
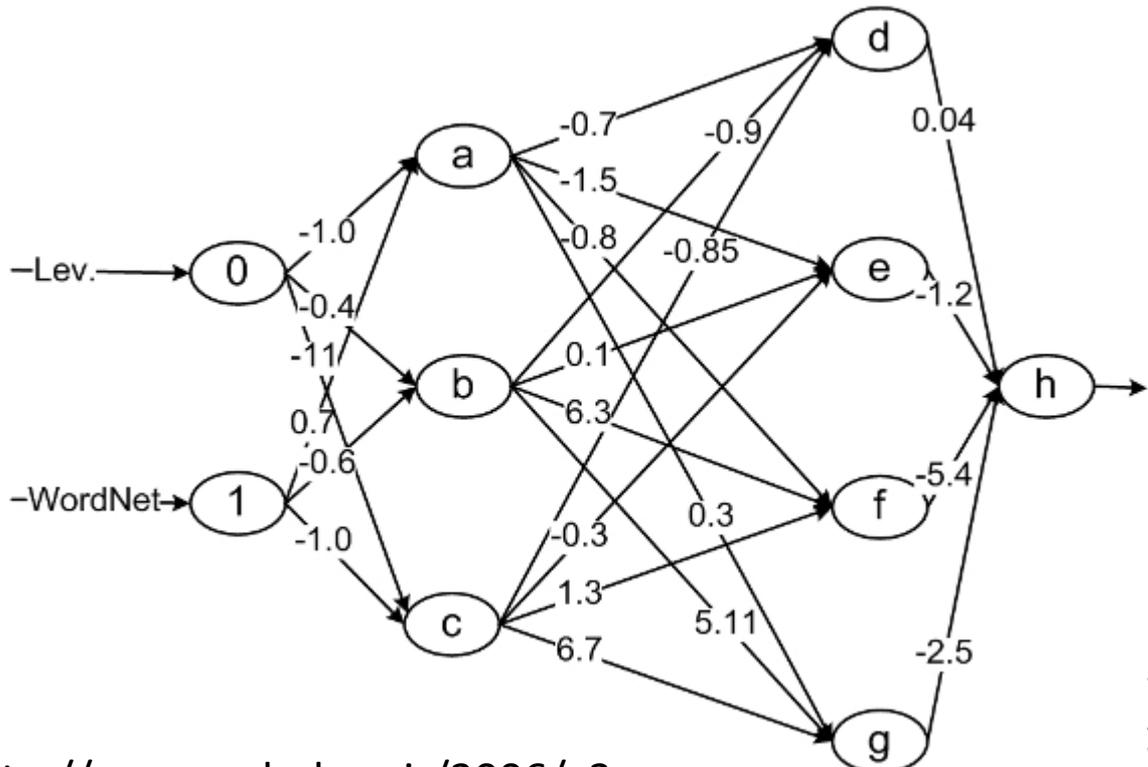






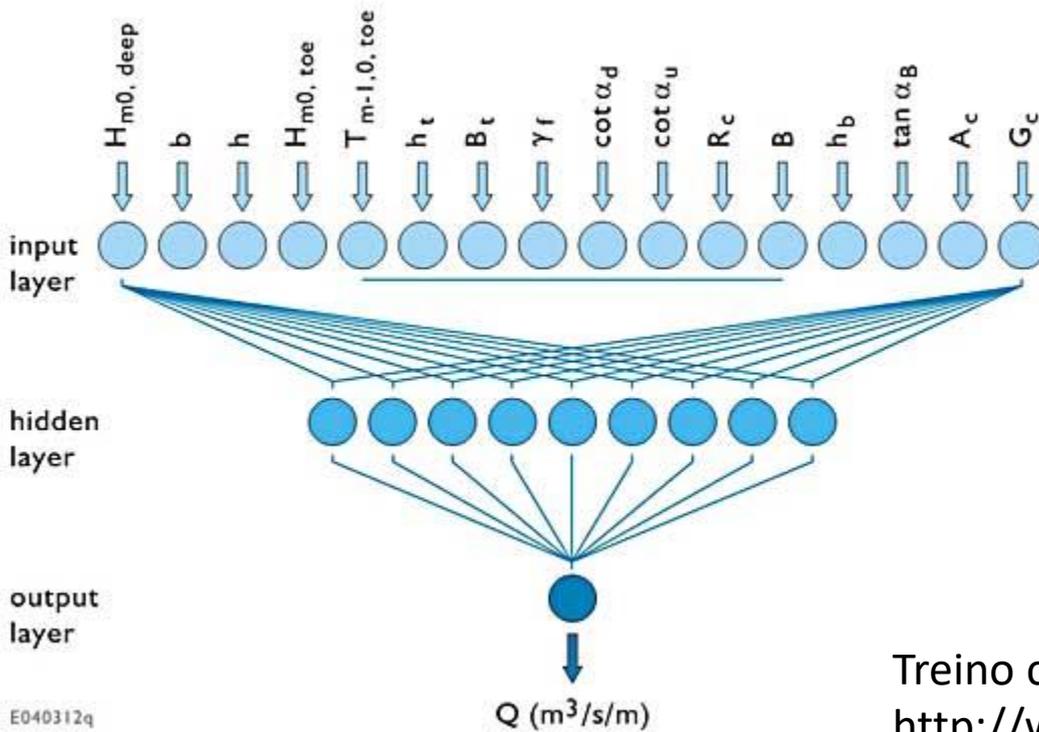
http://aemc.jpl.nasa.gov/activities/bio_regen.cfm





<http://www.webology.ir/2006/v3n3/a28.html>

neural network for wave overtopping



Treino com 6000 casos

<http://www.wldelft.nl/cons/area/wds/neural/index.html>

E040312q

Breakwat 3.0 New Release
 File New Project New Case Graph Settings Help

Show
 Hide
 Remove
 Rename
 Compare

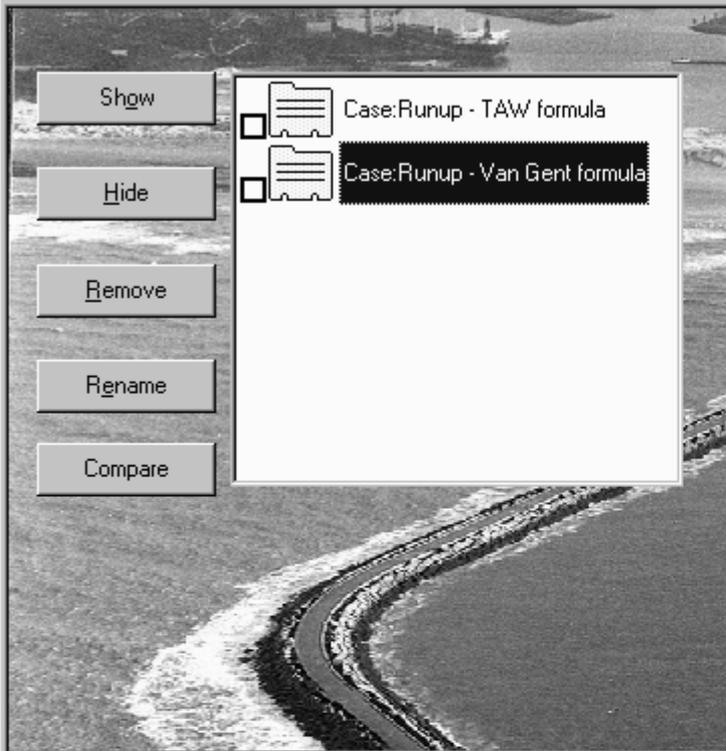
Case: Vertical caisson

Vertical caiss...
 β (deg)
 3 20.00
 4 30.00
 5 40.00
 6 50.00
 7 60.00
 8

buoyancy centre of mass

Vertical caisson

Structure type	2. Vertical (caisson), 2.1	
Response factor	2. Structural response, 2.5 Pressures, Forces and Safety factors	
Formula	Goda	
Output parameter	(HD) Design wave height	
	INPUT	
(B1) Berm width	2.00 (m)	<input type="checkbox"/>
(Bup) Width of upright section	10.0 (m)	<input type="checkbox"/>
(Hs0) Significant wave height at deep water	5.00 (m)	<input type="checkbox"/>
(hs) Water depth at site	5.00 (m)	<input type="checkbox"/>
(Tmax) Max. wave period	8.0000 (s)	<input type="checkbox"/>
(db) Depth of berm below SWL	4.00 (m)	<input type="checkbox"/>
(h') Distance from SWL to caisson base	10.0 (m)	<input type="checkbox"/>
(Rc) Crest freeboard	0.500 (m)	<input type="checkbox"/>
(tup/Bup) Relative horiz. dist. from c.gravity and heel	0.500 (-)	<input type="checkbox"/>
(cot(α_v) Foreshore slope	50.0 (-)	<input type="checkbox"/>
(β) Wave angle	TABLE	<input checked="" type="checkbox"/>
(μ_f) Coefficient of friction	2.00 (-)	<input type="checkbox"/>
(pf) Mass density of fill	2100 (kg/m ³)	<input type="checkbox"/>
(pc) Density of concrete cap	2400 (kg/m ³)	<input type="checkbox"/>
(pw) Water density	1025 (kg/m ³)	<input type="checkbox"/>
	OUTPUT	
(HD) Design wave height	TABLE	<input type="checkbox"/>
(Hs0/hs) Relative depth	TABLE	<input type="checkbox"/>
(h5Hsi) Depth 5*Hsi seaward from toe	TABLE	<input type="checkbox"/>
(Hsi) Incoming significant wave height	TABLE	<input type="checkbox"/>
(η^*) Elevation to which wave pressure is exerted	TABLE	<input type="checkbox"/>
(L) Local wave length	TABLE	<input type="checkbox"/>
(p1) wave pressure	TABLE	<input type="checkbox"/>
(pe) Bearing pressure at heel	TABLE	<input type="checkbox"/>
(pu) Uplift pressure	TABLE	<input type="checkbox"/>
(Fh) Total horizontal wave force	TABLE	<input type="checkbox"/>
(Fu) Total uplift force	TABLE	<input type="checkbox"/>
(Wup) Caisson weight per m length	TABLE	<input type="checkbox"/>
(Mh) Moment of Fh about heel	TABLE	<input type="checkbox"/>



Show

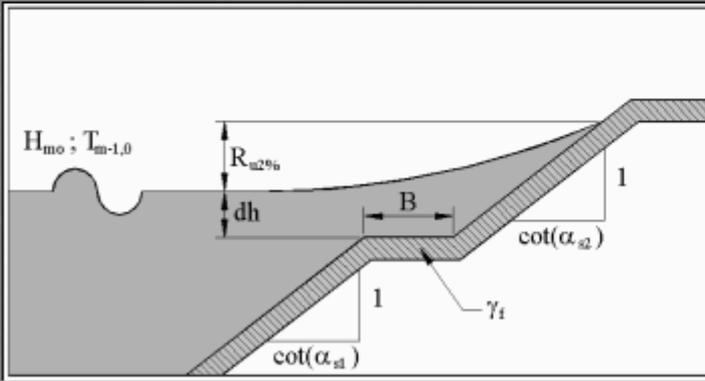
Hide

Remove

Rename

Compare

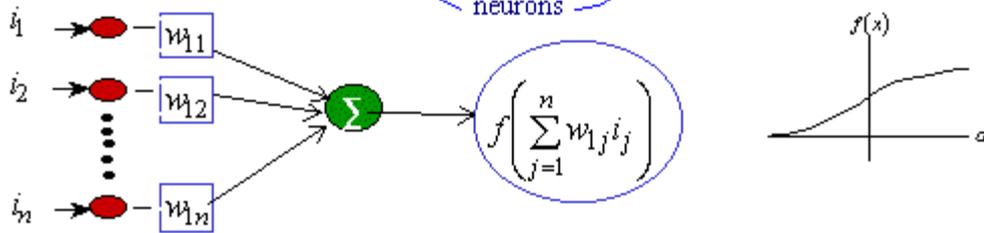
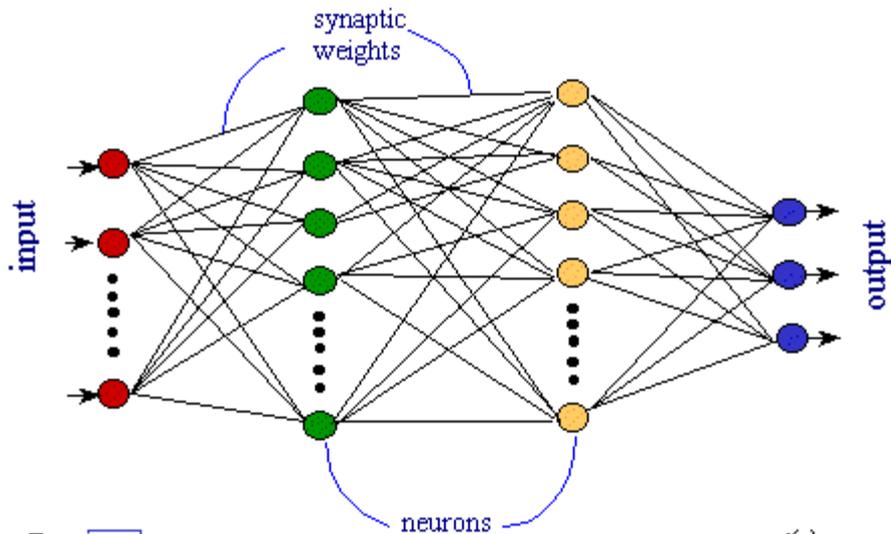
Case:Runup - TAW formula
 Case:Runup - Van Gent formula



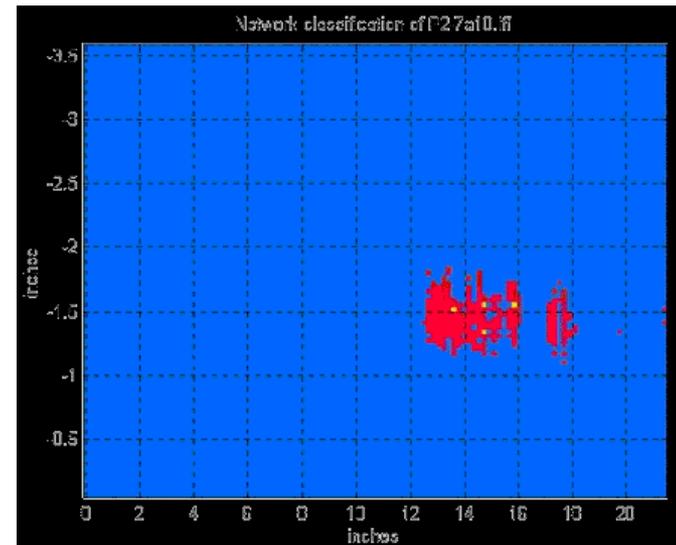
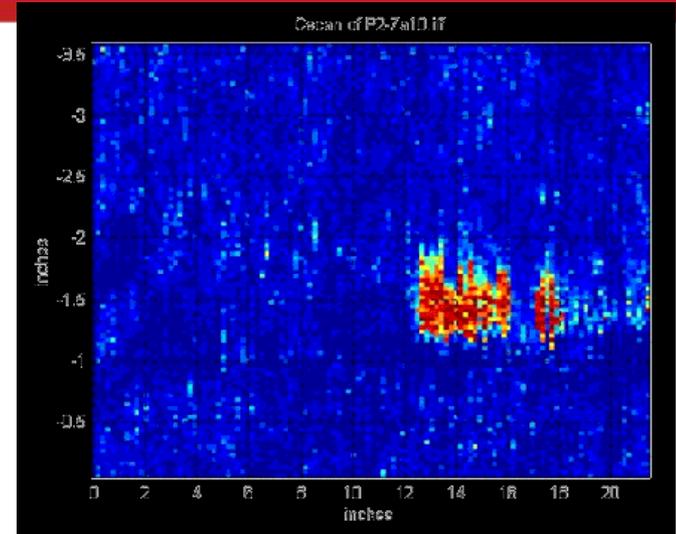
Runup - Van Gent formula

Structure type	1. Rubble mound structure, 1.1 Conventional breakwater
Response factor	1. Hydraulic response, 1.2 Runup
Formula	Runup on bermed slopes-van Gent formula
Output parameter	(Rup2%) 2% Runup ht. above swl
INPUT	
(Hs) Significant wave height	(m)
(Hm0) Spectral significant wave height	2.00 (m)
(Tp) Peak wave period	(sec)
(Tm) Mean wave period	(s)
(Tm-10) Spectral period	5.00 (s)
(β) Wave angle	0 (deg)
(cot(αs)) Structure slope angle	(-)
(cot(αs1)) Cotangent of lower structure slope angle	3.00 (-)
(cot(αs2)) Cotangent of upper structure slope angle	3.00 (-)
(B) Berm width	2.00 (m)
(d) Distance from SWL to berm	1.00 (m)
(P) Notional Permeability factor	(-)
(γf) Roughness reduction factor	1.00 (-)
(c0) Van Gent coefficient	1.35 (-)
(c1) Van Gent coefficient	4.70 (-)
(P) Exceedance probability	(%)
(Conf) Confidence bands	check to use (-)
(Rup) Runup ht. above swl	(m)
OUTPUT (-)	
(Rup2%) 2% Runup ht. above swl	3.670 (m)
(Rup/Hs) Relative runup level	(-)
(Rup2%/Hs) Relative runup level	(-)
(Rup2%/Hm0) Relative runup level	1.835 (-)
(cot(αrep)) representative slope	3.25 (-)
(ξm) Breaker parameter	(-)
(ξp) Breaker parameter	(-)
(ξD) Breaker parameter	1.359 (-)
(ξs-1) Breaker parameter	(-)
(γb) Berm reduction factor	(-)
(γβ) Oblique reduction	1.00 (-)
(γTot) Total reduction	1.00 (-)

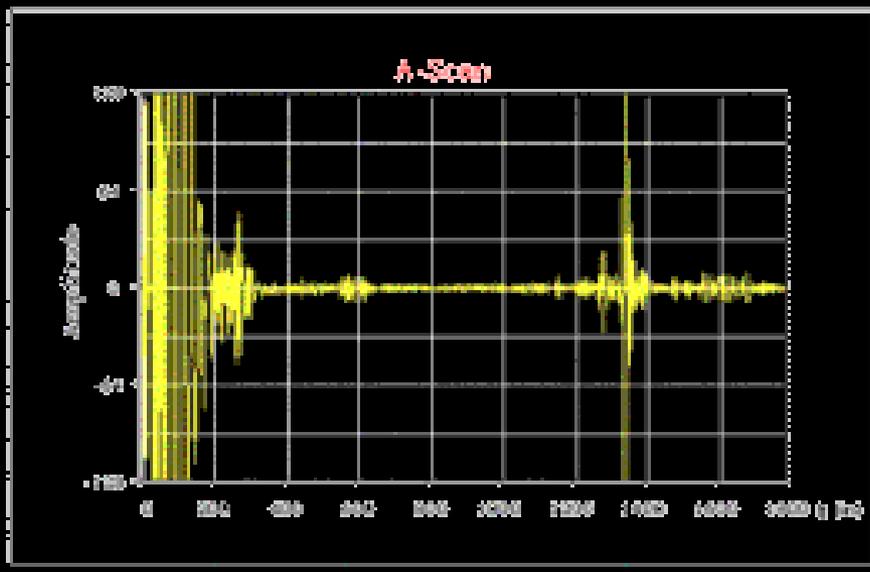
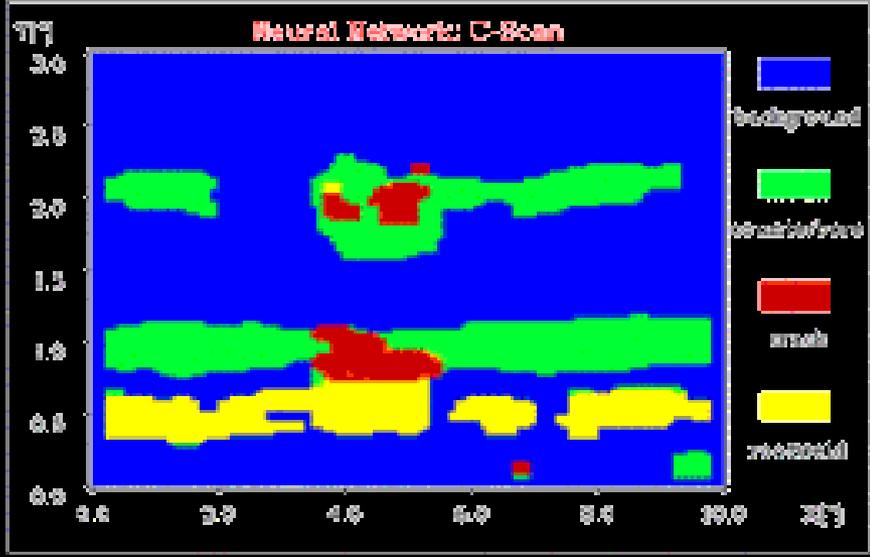
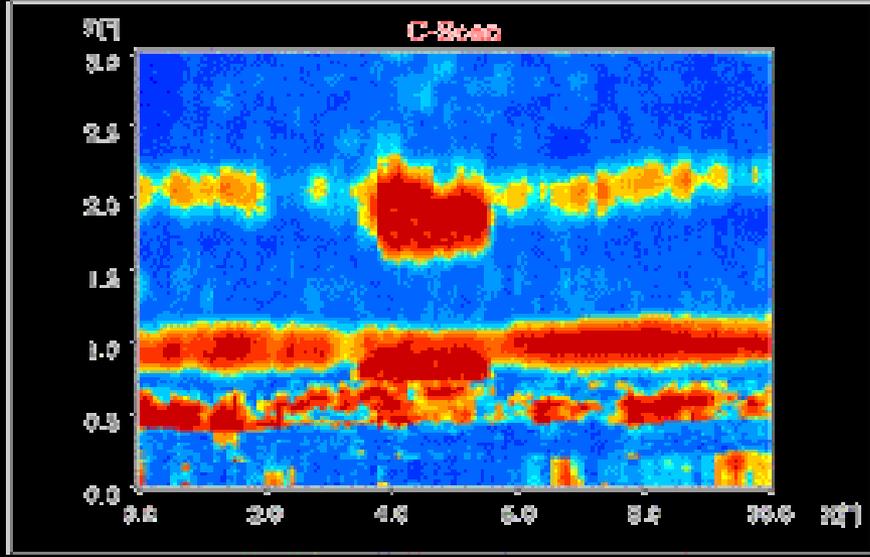
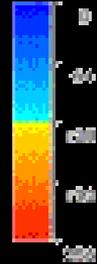
ULTRASONIC DETECTION OF INTERGRANULAR STRESS CORROSION



<http://www.ndt.net/article/v05n07/spanner2/spanner2.htm>



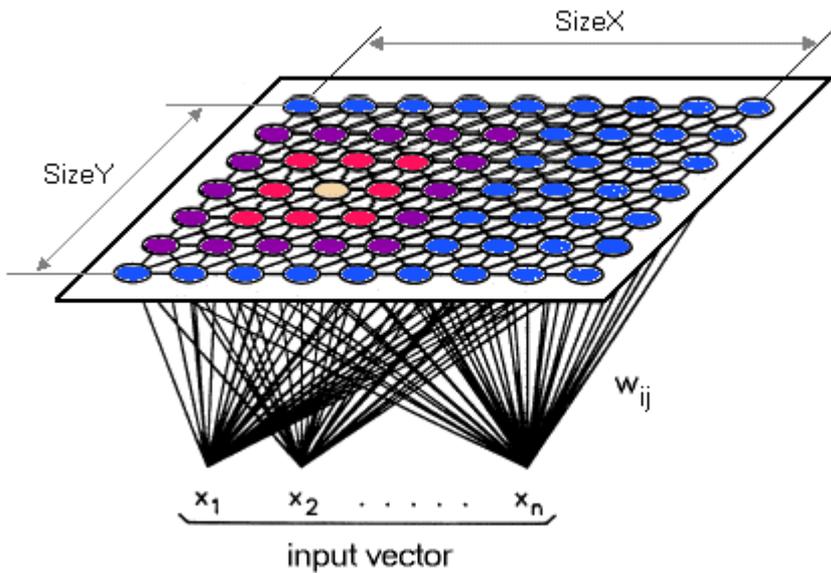
WELD INSPECTION AND DATA ANALYSIS



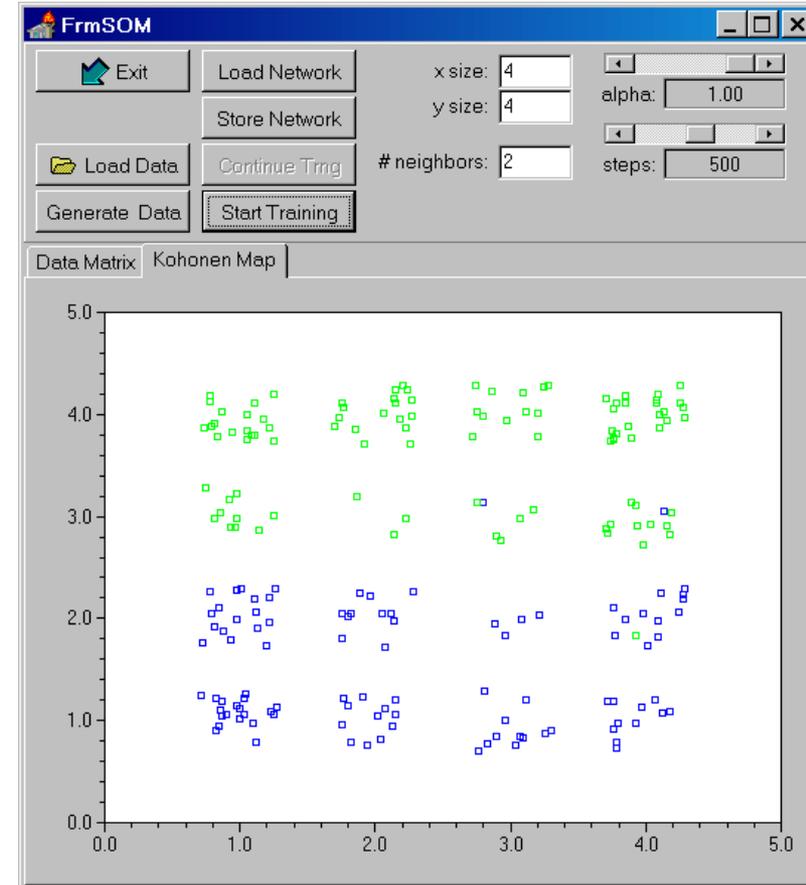
FILE NAME: 1UP2A.RAS

INCIDENT ANGLE: 40.00 degree
 PIPE THICKNESS: 0.89"
 VELOCITY: 0.1227 microsec
 WEDGE DELAY: 7.44 microsec (= 100 pts)
 SAMPLING RATE: 25.00 MHz
 SATURATION RANGE: 150 pts
 WELD AREA WIDTH: 1.00"

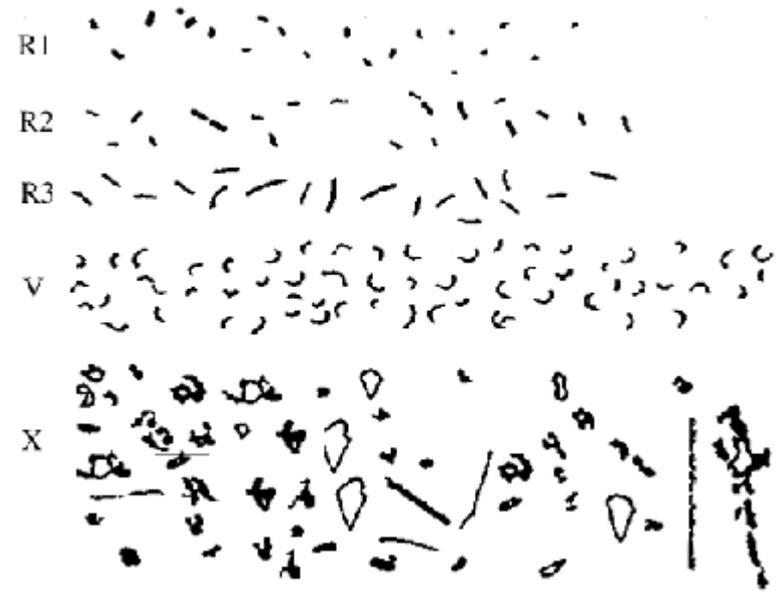
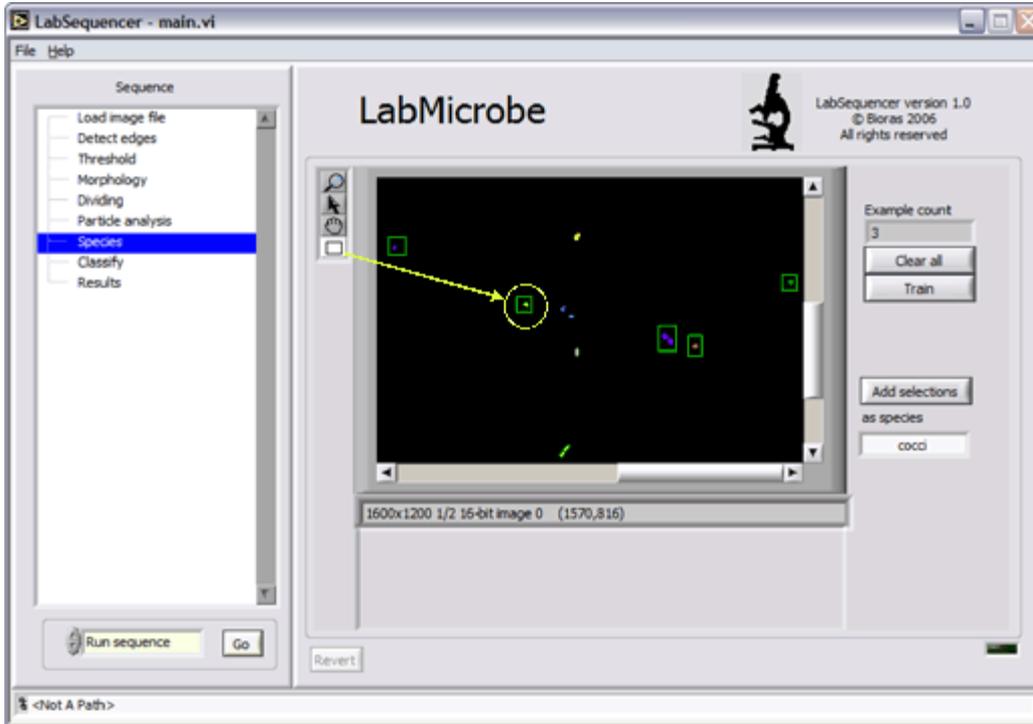
Self-Organizing Maps.



<http://www.lohninger.com/kohonen.html>



Neural network classification of marine bacteria



<http://www.bioras.com/Products/LabMicrobe/labmicrobe3.html>

R2010b Documentation → Neural Network Toolbox

View documentation for other releases

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• Getting Started

▼ User's Guide

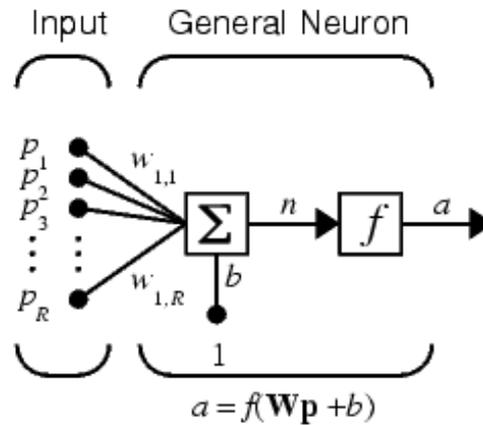
- Network Objects, Data and Training Styles
- ▼ Multilayer Networks and Backpropagation Training
 - Introduction
 - ▼ **Multilayer Neural Network Architecture**
 - Feedforward Network
- Collect and Prepare the Data
- Create, Configure and Initialize the Network
- Train the Network
- Post-Training Analysis (Network Validation)
- Use the Network
 - Automatic Code Generation
 - Limitations and Cautions
- Dynamic Networks
- Control Systems
- Radial Basis Networks
- Self-Organizing and Learning Vector Quantization Nets
- Adaptive Filters and Adaptive Training
- Advanced Topics
- Historical Networks
- Network Object Reference
- Function Reference
- Mathematical Notation
- Blocks for the Simulink Environment
- Code Notes
- Bibliography
- Glossary

Multilayer Neural Network Architecture

This section presents the architecture of the multilayer feedforward neural network.

Neuron Model (logsig, tansig, purelin)

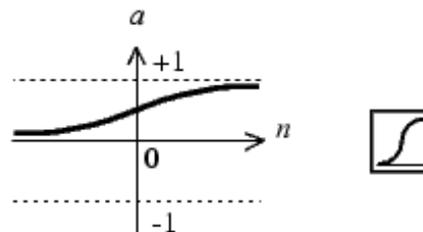
An elementary neuron with R inputs is shown below. Each input is weighted with an a forms the input to the transfer function f . Neurons can use any differentiable transfer



Where

R = number of elements in input vector

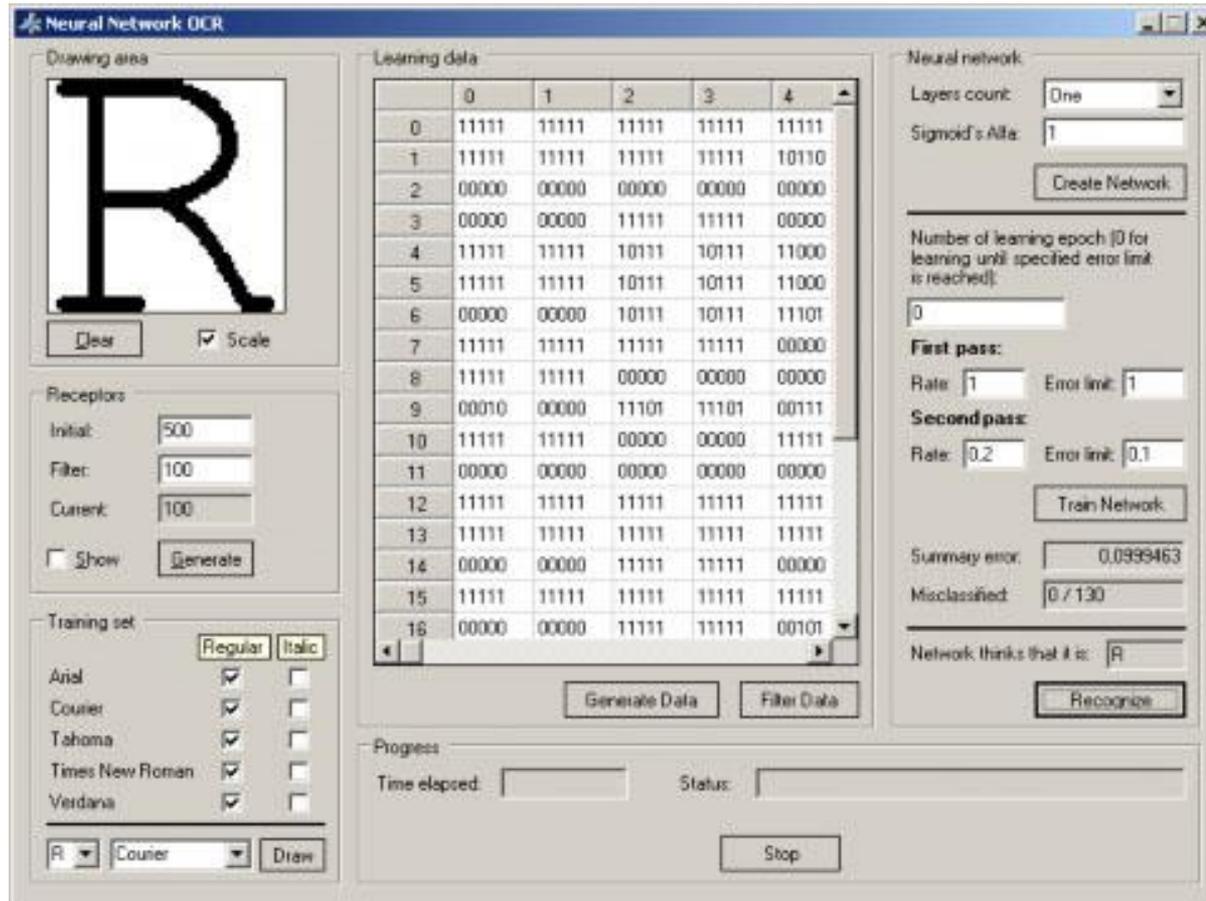
Multilayer networks often use the log-sigmoid transfer function [logsig](#).



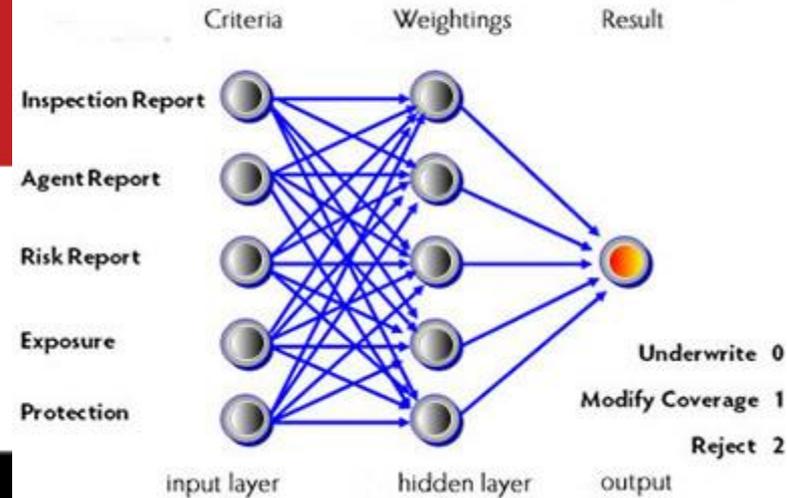
$a = \text{logsig}(n)$

Log-Sigmoid Transfer Function

Neural Network OCR

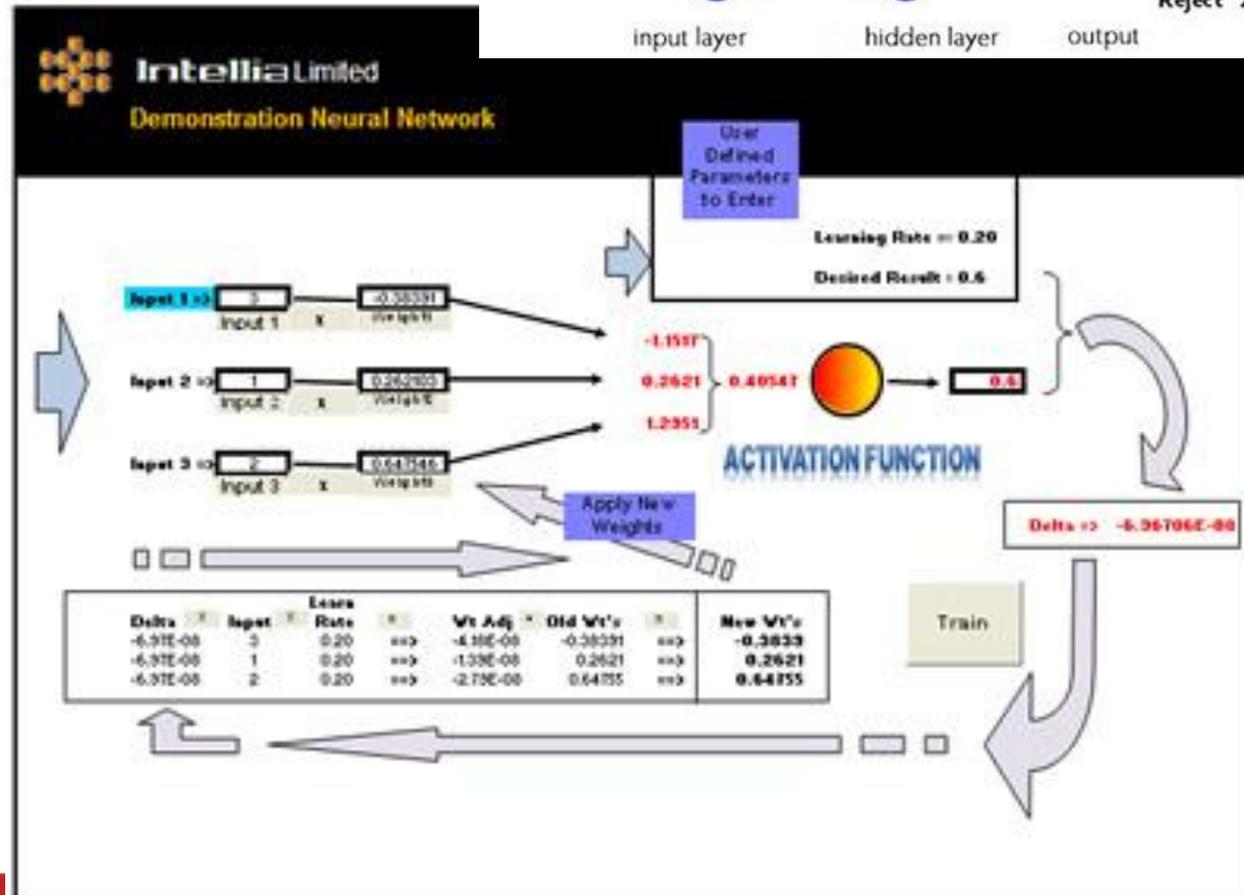


- http://www.codeproject.com/KB/cs/neural_network_ocr.aspx



- deadly accuracy usually between 95% to 97% far higher than any team of human decision makers score by parallel comparison, but that only a human operator can "explain" to the end-consumer why or why not their application for insurance was rejected, needs to be modified, or is accepted at that particular rate or premiums to be paid.

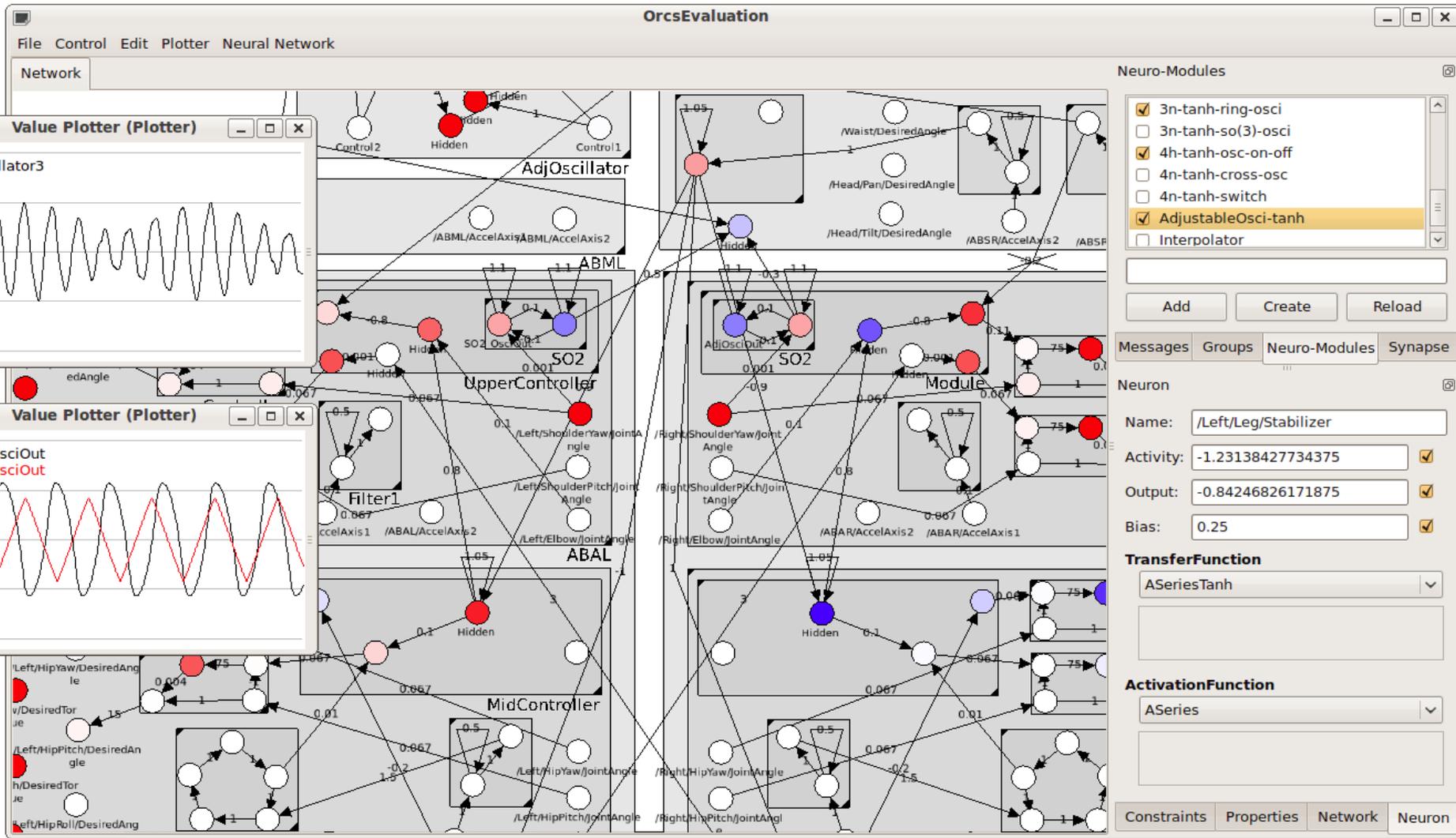
- <http://www.intellia.co.nz/intelligent%20systems%20development.html>



OrcsEvaluation

File Control Edit Plotter Neural Network

Network



Value Plotter (Plotter)

Oscillator3

Value Plotter (Plotter)

AdjOsciOut

Neuro-Modules

- 3n-tanh-ring-osci
- 3n-tanh-so(3)-osci
- 4h-tanh-osc-on-off
- 4n-tanh-cross-osc
- 4n-tanh-switch
- AdjustableOsci-tanh
- Interpolator

Add Create Reload

Messages Groups Neuro-Modules Synapse

Neuron

Name: /Left/Leg/Stabilizer

Activity: -1.23138427734375

Output: -0.84246826171875

Bias: 0.25

TransferFunction

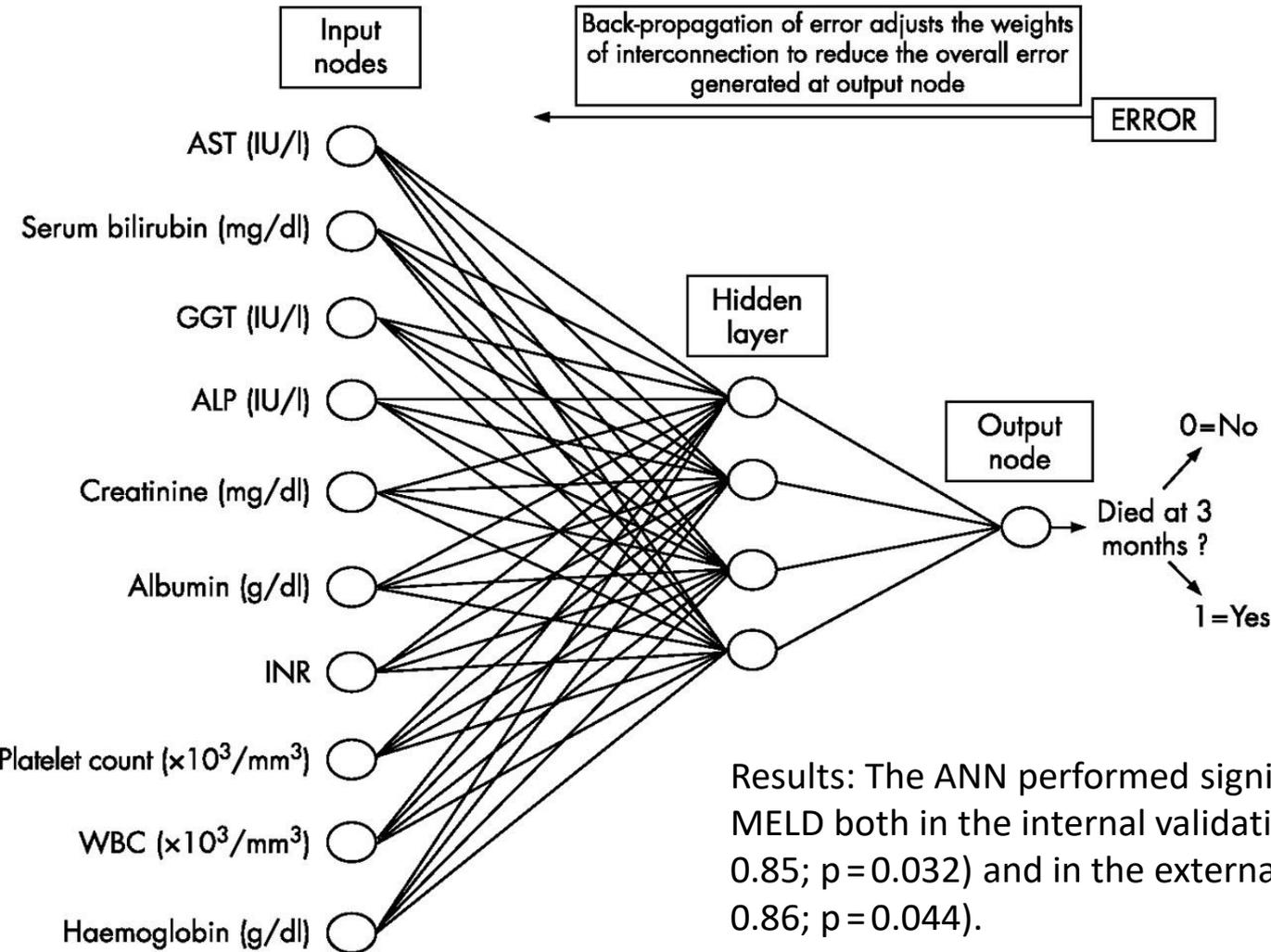
ASeriesTanh

ActivationFunction

ASeries

Constraints Properties Network Neuron

Previsão morte cirrose fígado



Results: The ANN performed significantly better than MELD both in the internal validation group (AUC=0.95 v 0.85; p=0.032) and in the external cohort (AUC=0.96 v 0.86; p=0.044).

Reconhecimento de matrículas

Plate Log

Alarm Log

Event Log

Search

User Hotlists

Setup

Log Off

Plate Log
TALON^{SP}

LD 07 EKE



Video

<< >>

Manual Entry...

Correct Entry...

Recognitions: 643

Plate	Lane Label	Time	Nation IC
RE54XSG	Kidwell Park	07 Apr 2009 08:05:53	GB
DN54EKJ	Kidwell Park	07 Apr 2009 08:03:02	GB
AU08SYO	Kidwell Park	07 Apr 2009 07:58:05	GB
LD07EKE	Kidwell Park	07 Apr 2009 07:55:52	GB
WM08GDC	Kidwell Park	07 Apr 2009 07:54:30	GB



<<<< << Pause >> >>>>

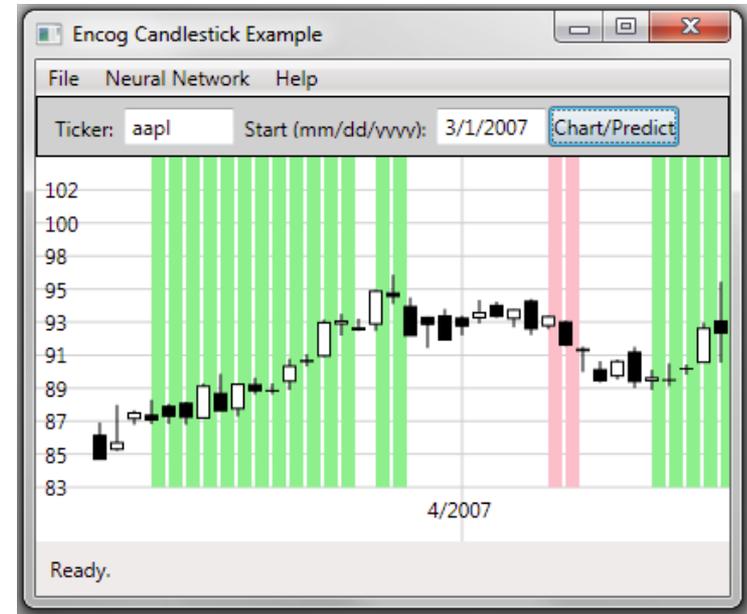
Previsão tendências mercado



<http://www.v-eva.com/products/Forex-NeuroMaster-2.0-PRO.html>

<http://www.devx.com/opensource/Article/44014/0/page/2>

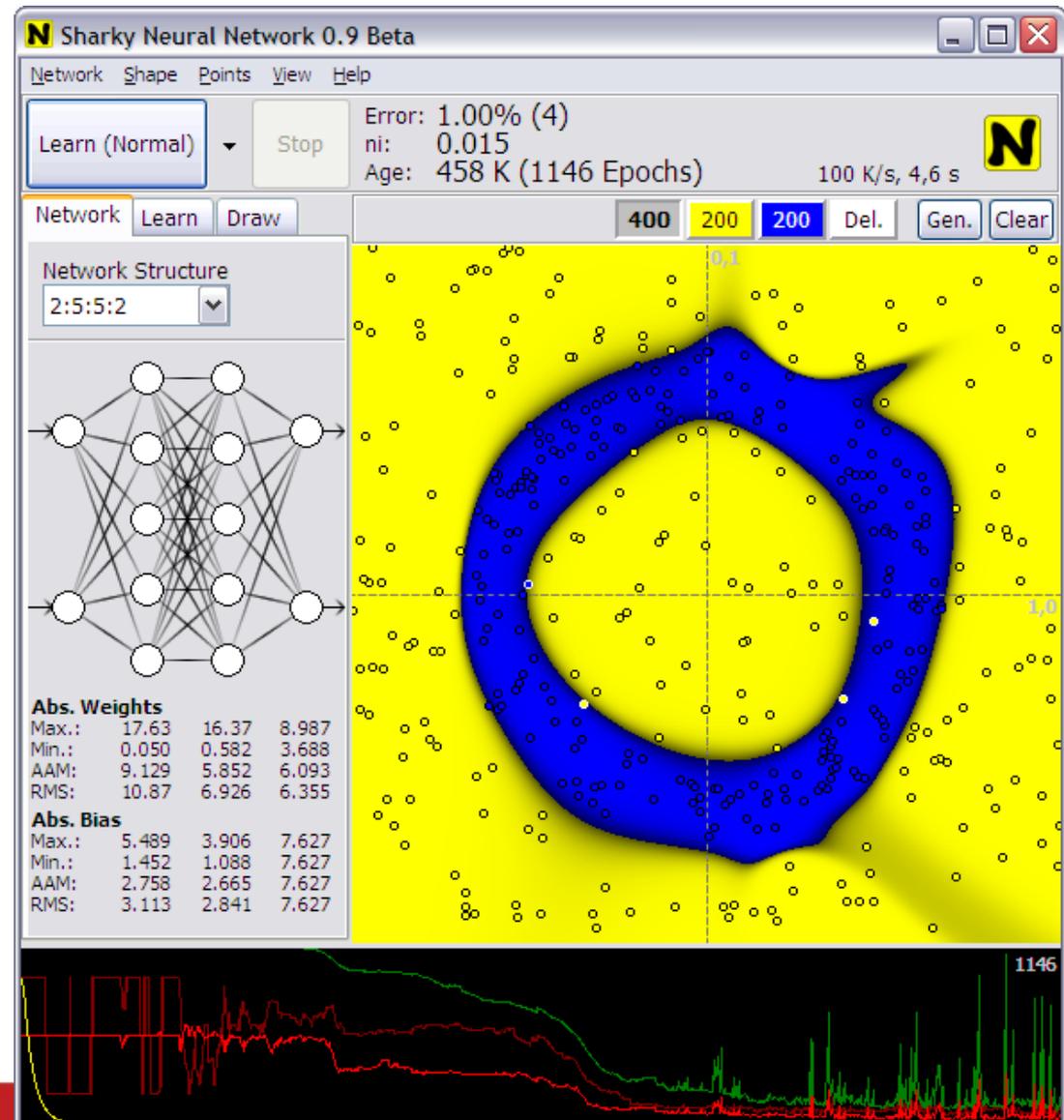
- Prever mercado em subida ou mercado em queda



<http://www.heatonresearch.com/encog>

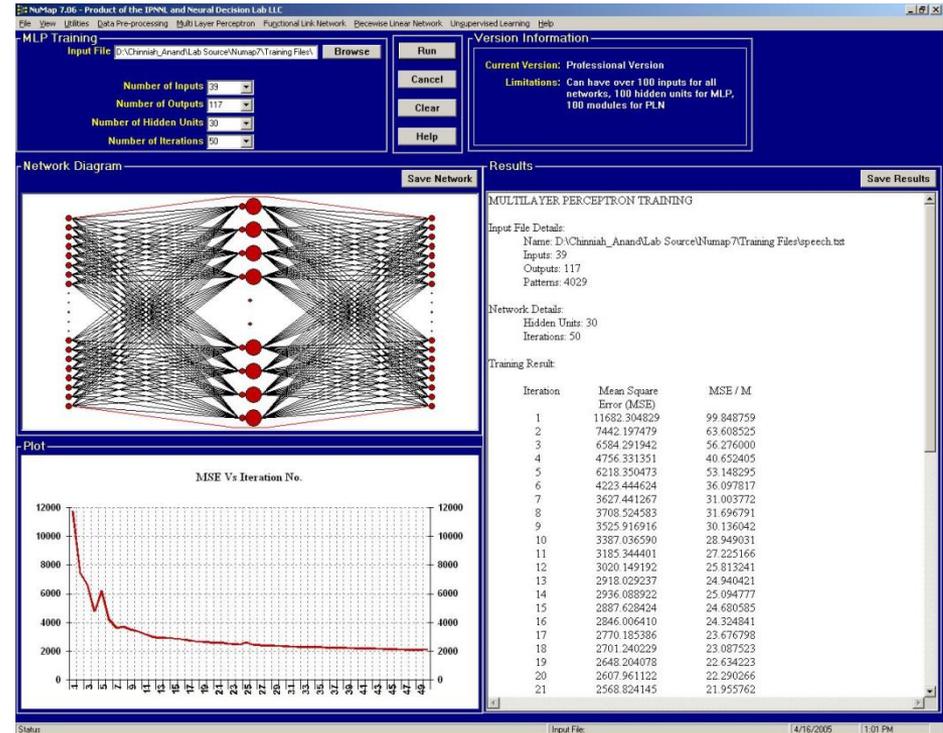
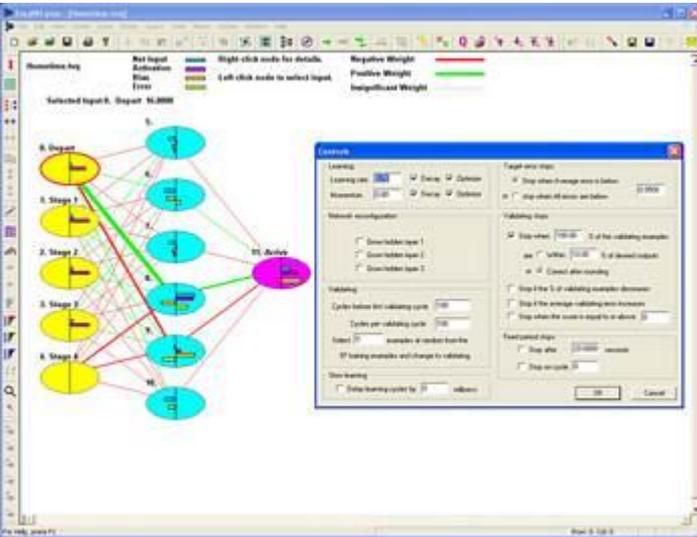


Sharky Neural Network



- http://www.sharktime.com/us_SharkyNeuralNetwork.html

Pequenos softwares



<http://www.easynn.com/>

- <http://www.neuraldl.com/>

- http://www.solarnavigator.net/biology/biology_images/
- <http://www.emc.maricopa.edu/faculty/farabee/biobk>
- http://elib.uni-stuttgart.de/opus/volltexte/2010/5165/pdf/Keng_Been_Ang_Dissertation_25.02.2010.pdf