Redes Neuronales

Adaptive-Network-Based

Fuzzy Inference Systems

(redes ANFIS)

Profe: Pancho Tamarit

Alumno: Carlos Budde

- "Esta goma es blanca"

- "Y... sí"

$$\text{color}_{\text{blanco}}(\textit{Maped}) = 1$$

- "Esta goma es blanca"

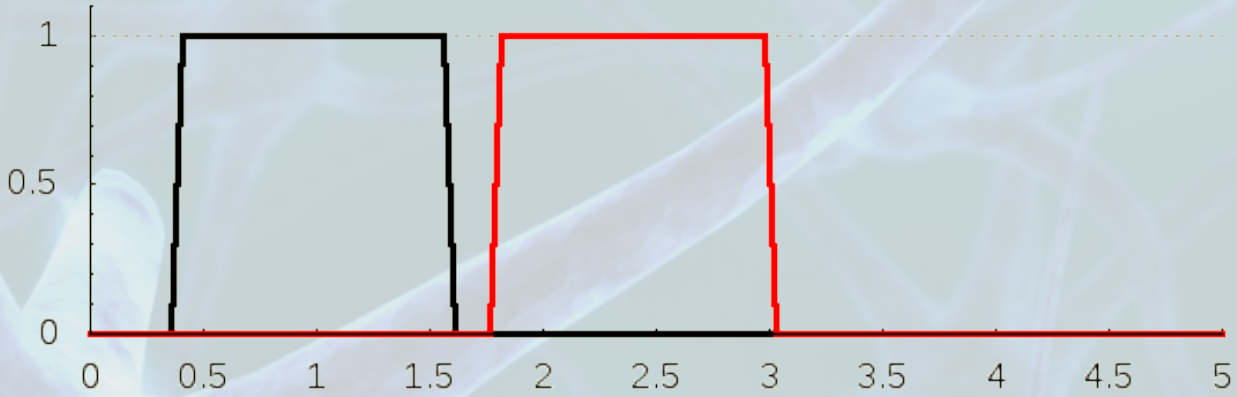
- "Mmm... más o menos"

$$color_{blanco}\ (\textit{Faber-Castell}) = 0.65$$

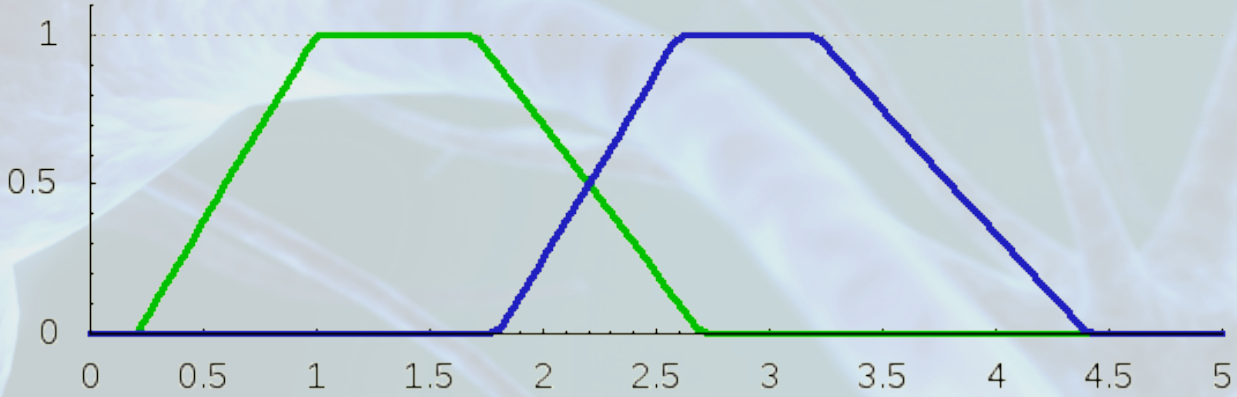
$$color_{gris}\ (\textit{Faber-Castell}) = 0.35$$

Redes Neuronales: ANFIS

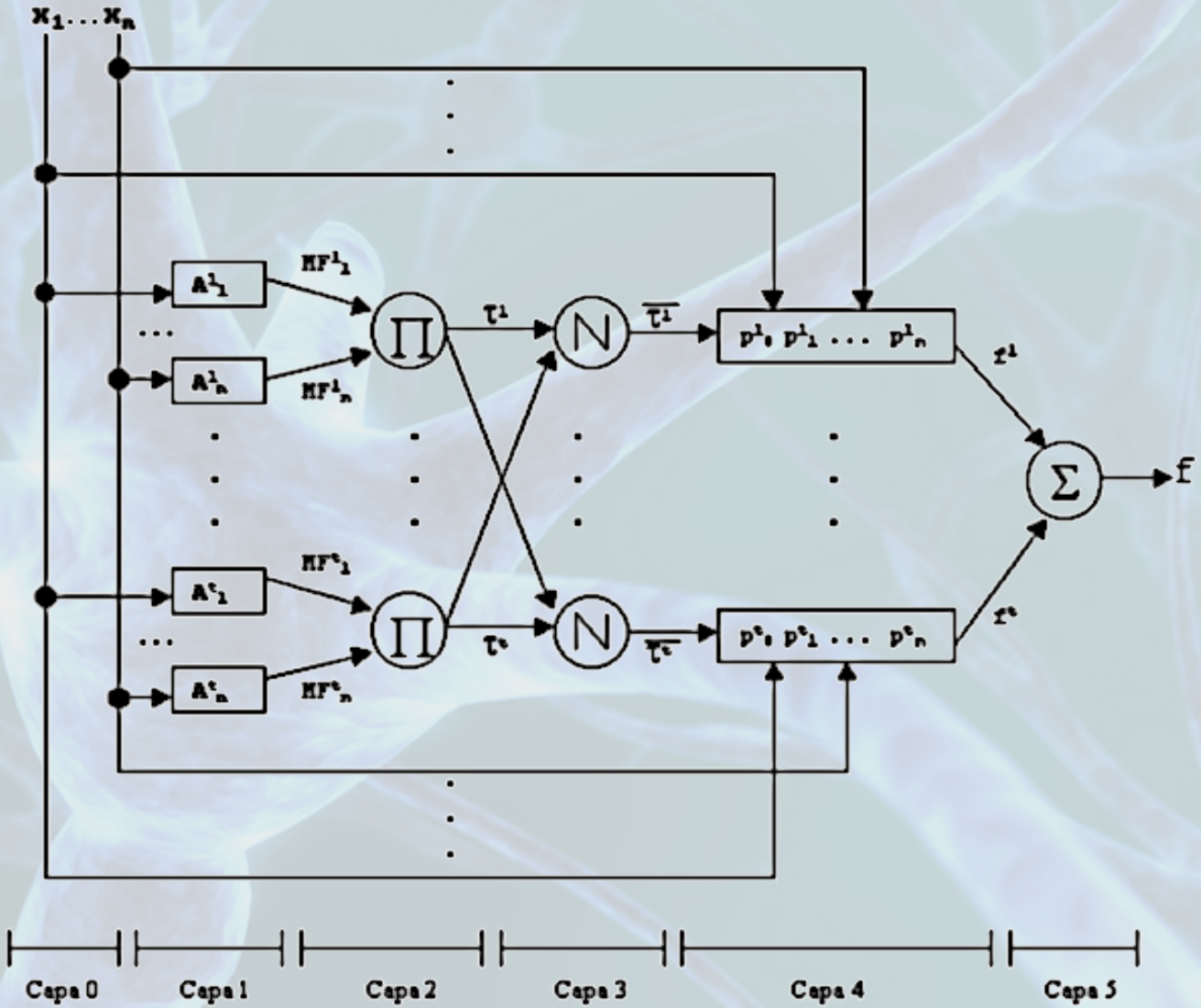
Caso “crisp”:



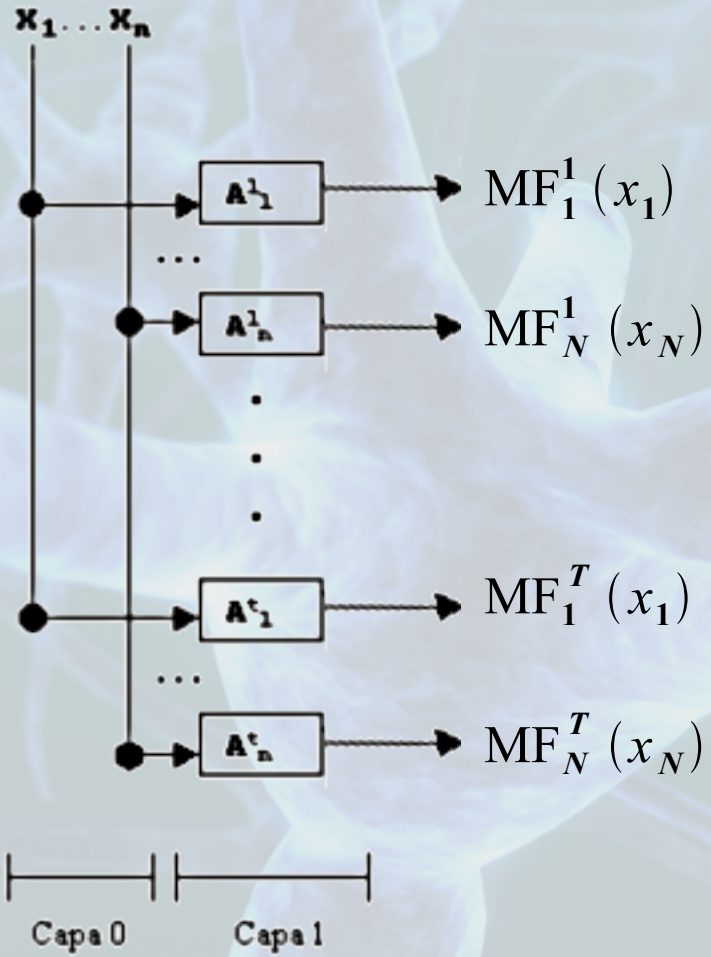
Caso “difuso”:



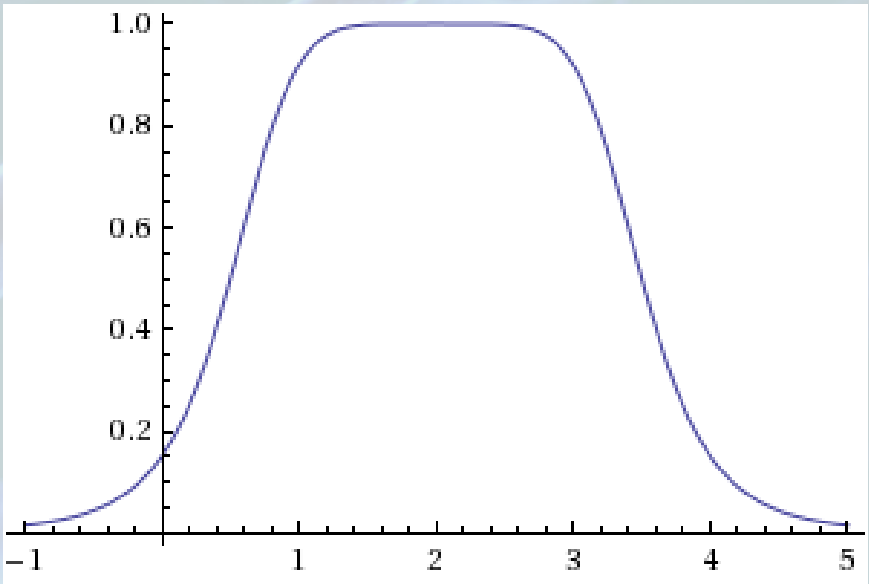
Redes Neuronales: ANFIS



Redes Neuronales: ANFIS

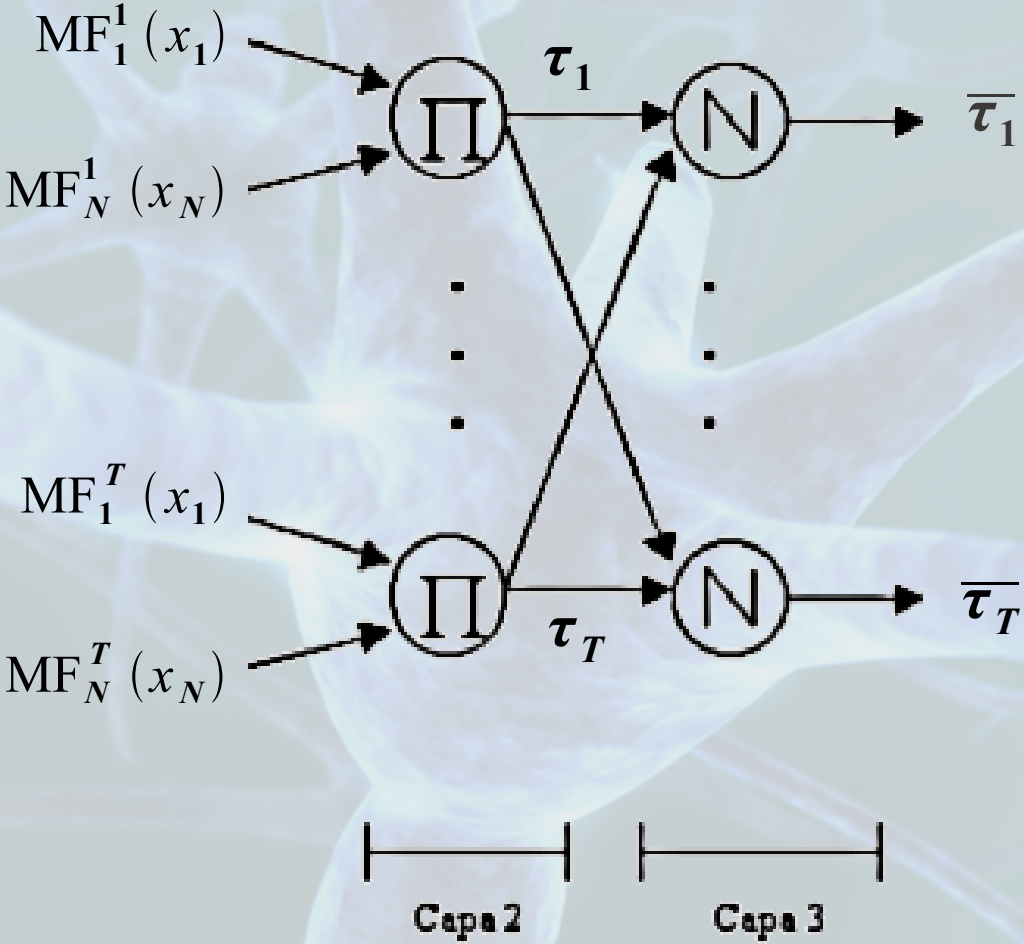


Funciones membresía de tipo bell:



$$f_{a,b,c}(x) = \frac{1}{1 + \left| \frac{x-c}{a} \right|^{2b}}$$

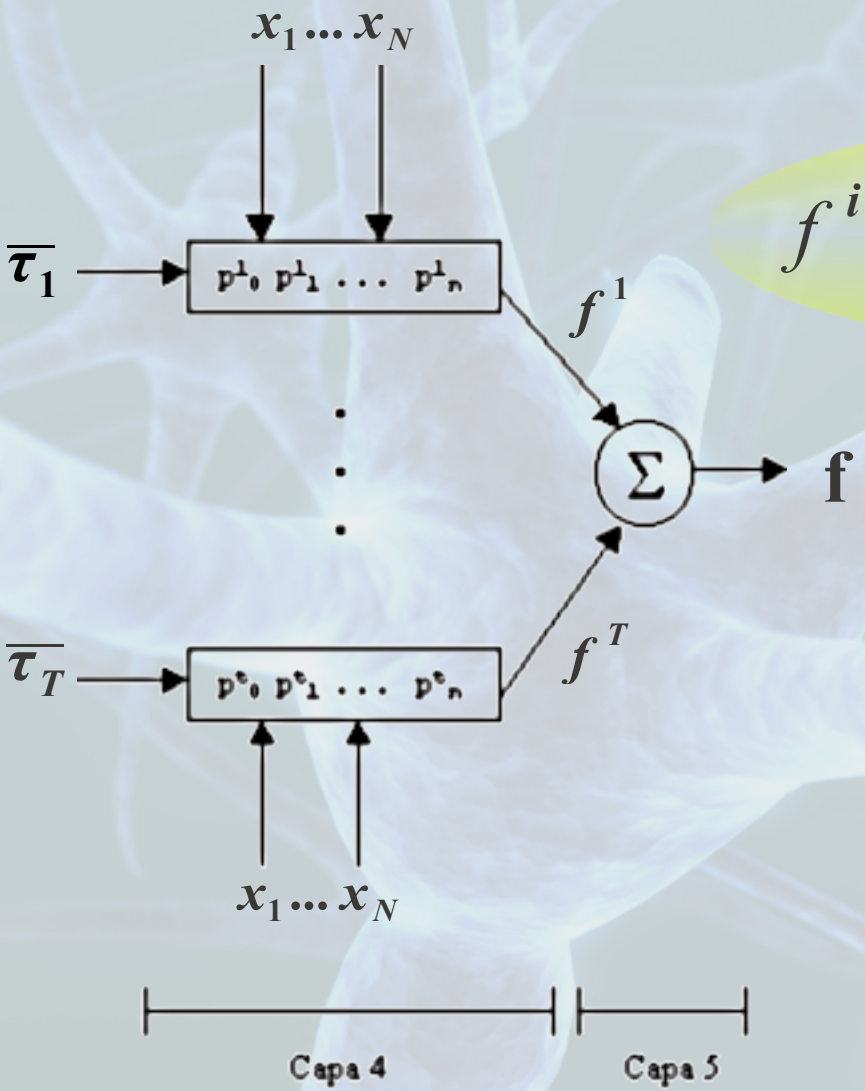
Redes Neuronales: ANFIS



$$\tau_i(\vec{x}) = \prod_{j=1}^{N} MF_j^i(\vec{x})$$

$$\overline{\tau_i}(\vec{x}) = \frac{\tau_i(\vec{x})}{\sum_{j=1}^{T} \tau_j(\vec{x})}$$

Redes Neuronales: ANFIS

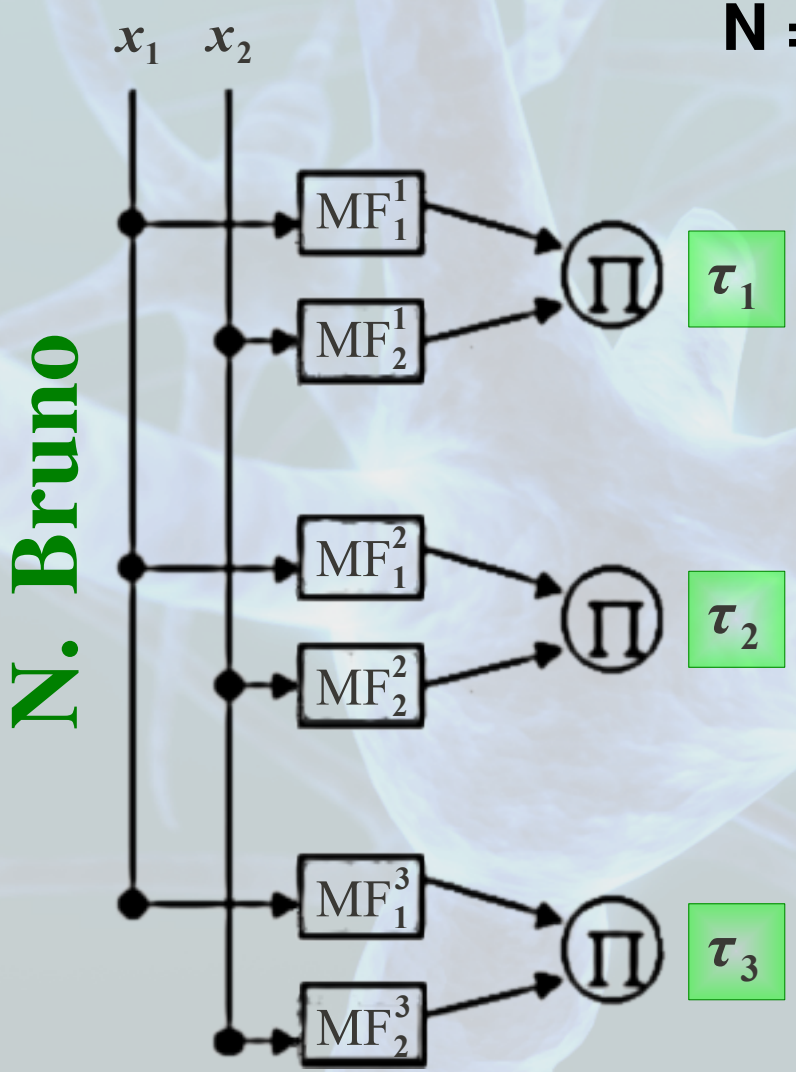


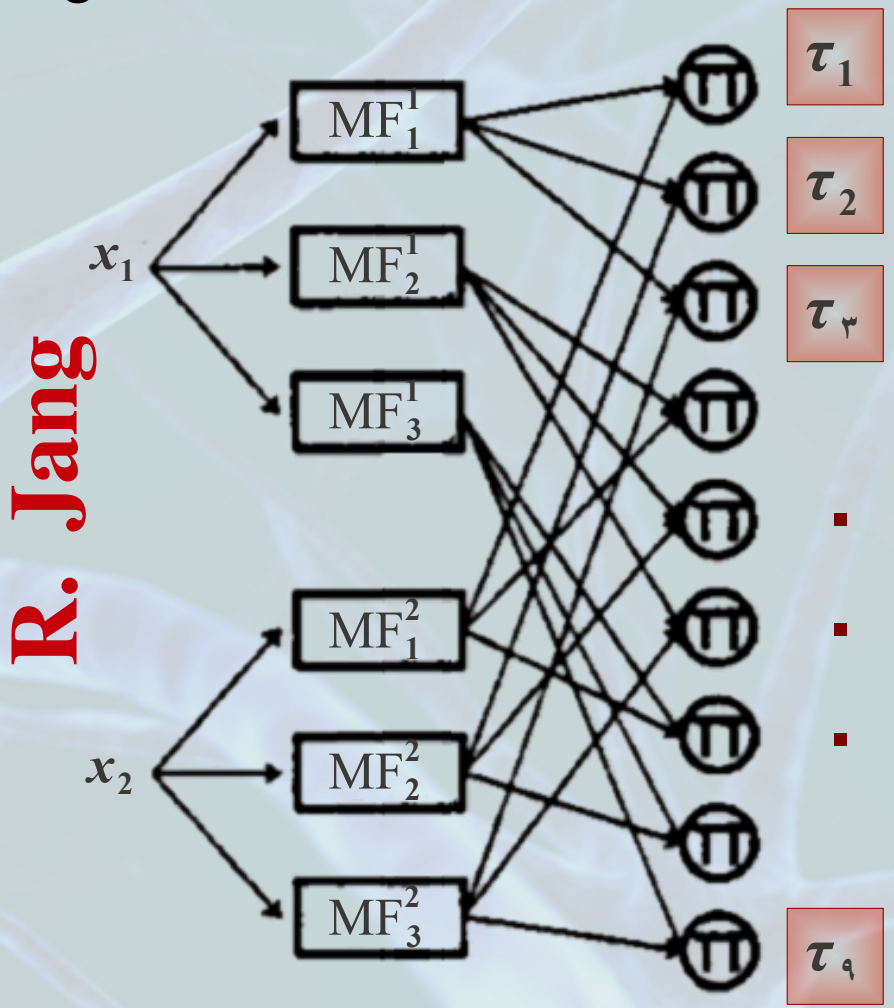
$$f^i(\vec{x}) = (p_0^i + x_1 p_1^i + \ldots + x_N p_N^i)\ \overline{\tau}_i$$

$$\mathbf{f}(\vec{x}) = \sum_{i=1}^{T} f^i(\vec{x})$$

Redes Neuronales: ANFIS

N = 2 T = 3





Redes Neuronales: ANFIS

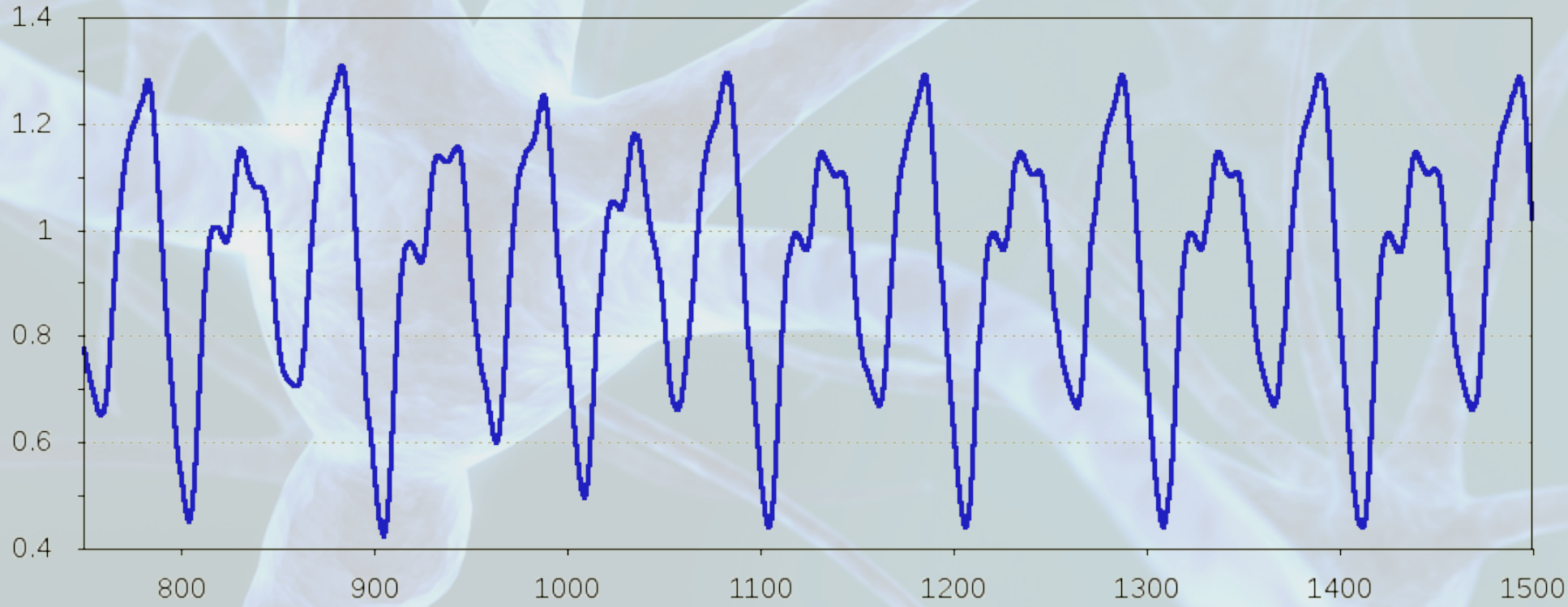
Mackey-Glass differential delay equation:

$$\dot{x}(t) = \frac{0.2\ \ x(t-\tau)}{1+x^{10}(t-\tau)} - 0.1\,x(t)$$

Parameters:

$\tau = 17$

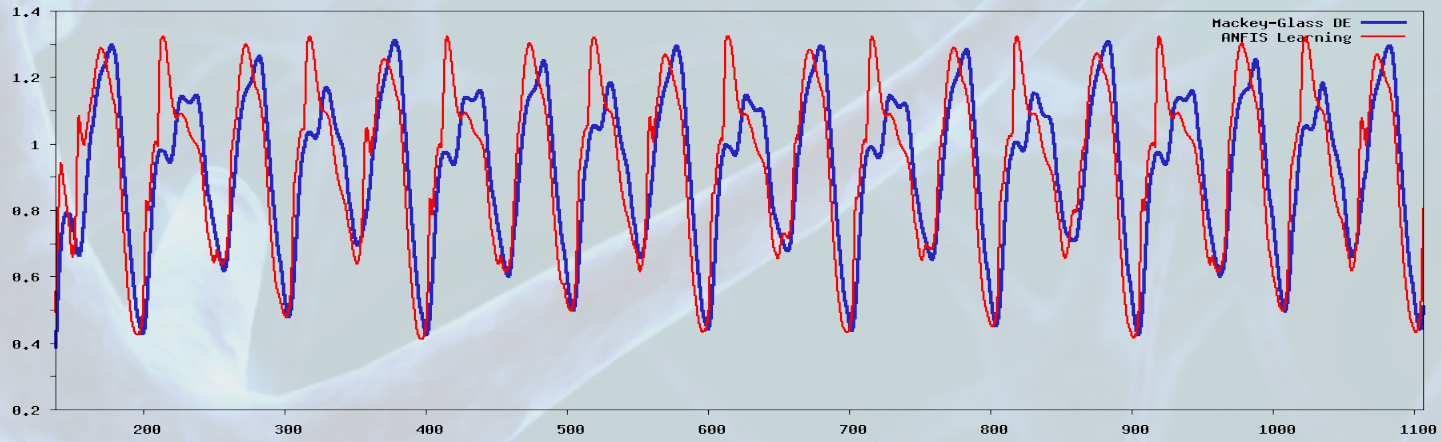
$x(0) = 1.2$



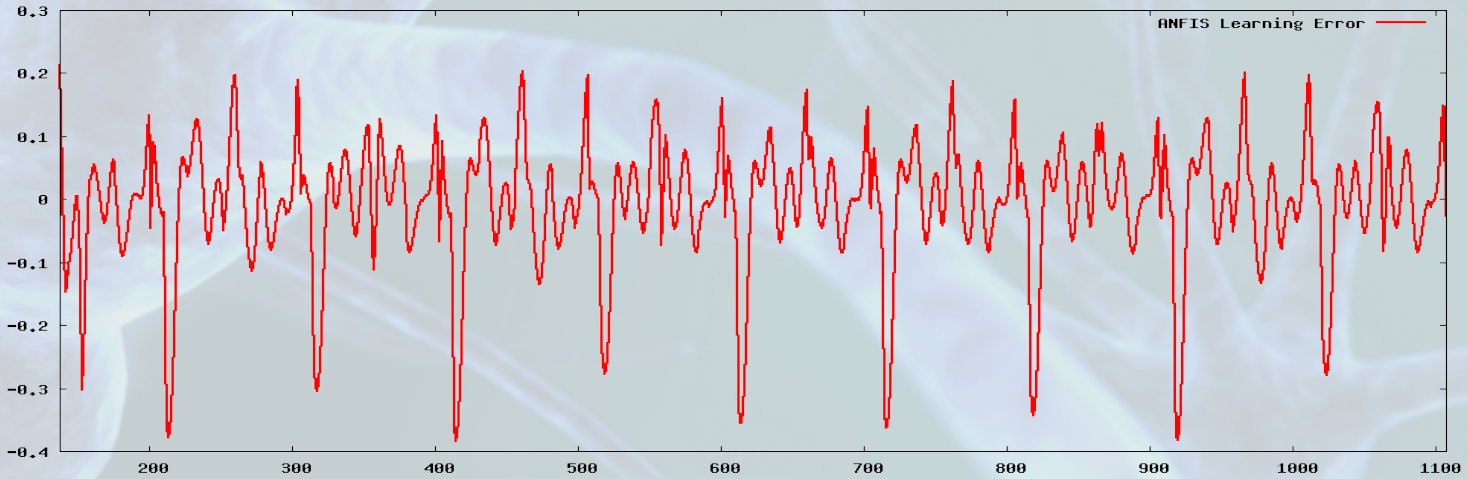
Redes Neuronales: ANFIS

N.Bruno

T = 2
N = 4



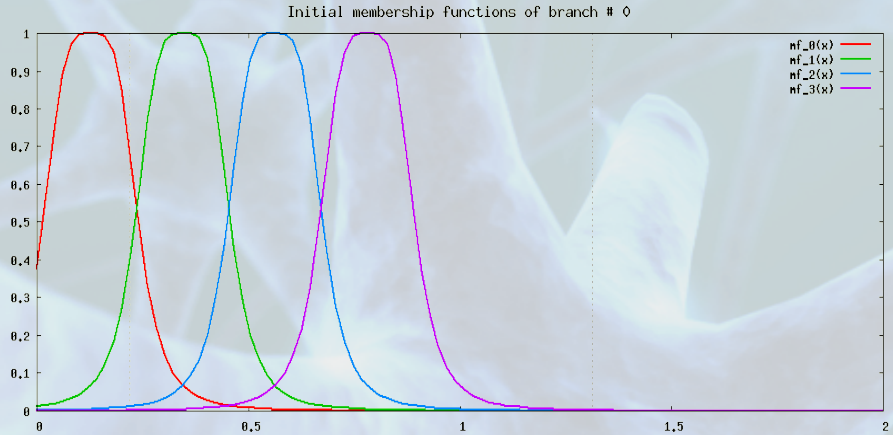
error ~
[-0.4 , 0.2]

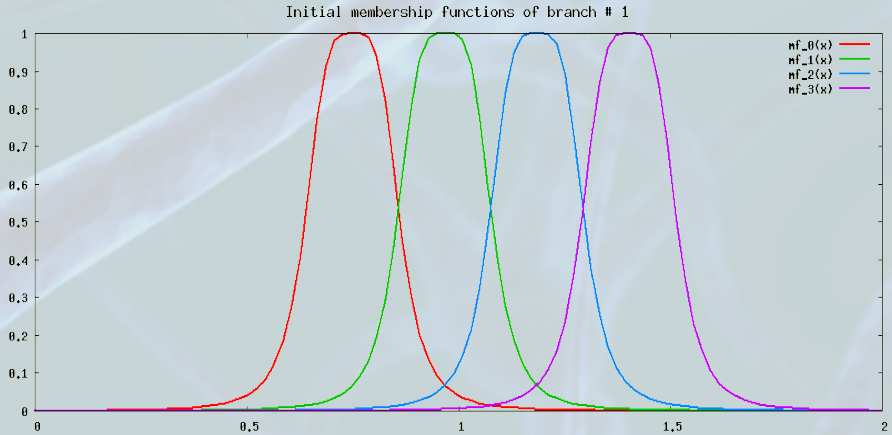


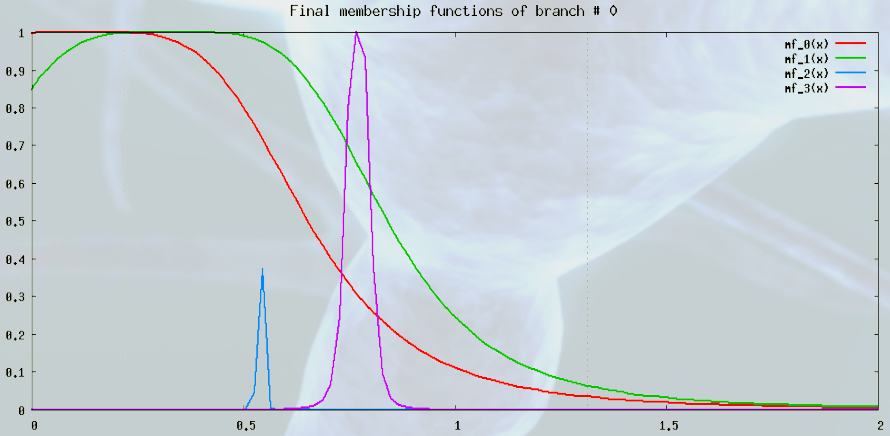
Redes Neuronales: ANFIS

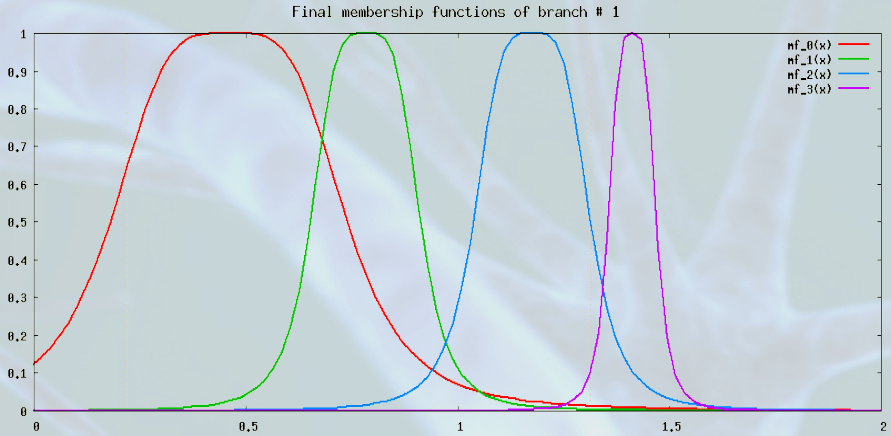
N.Bruno

T=2 N=4









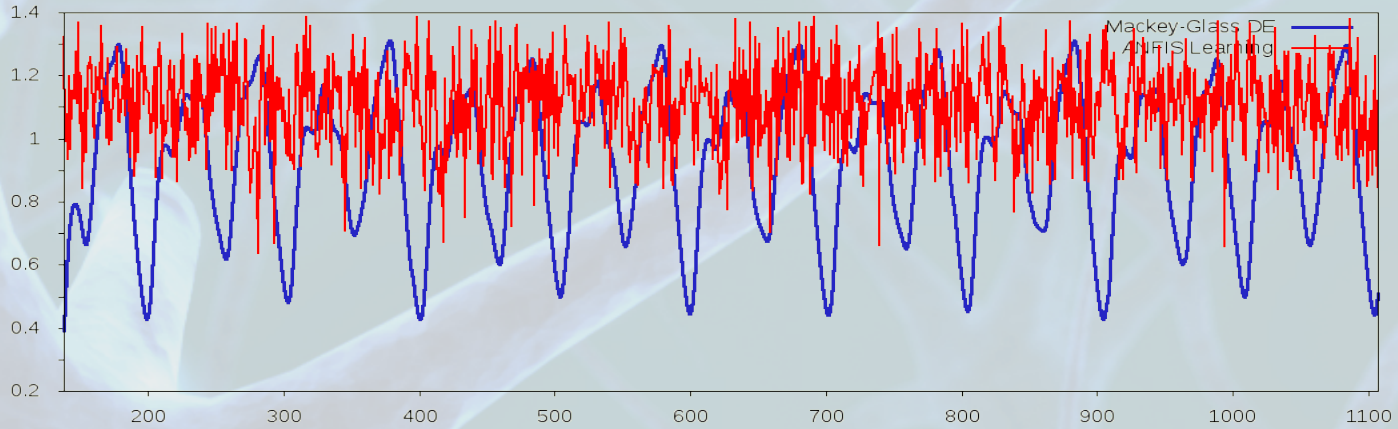
Redes Neuronales: ANFIS

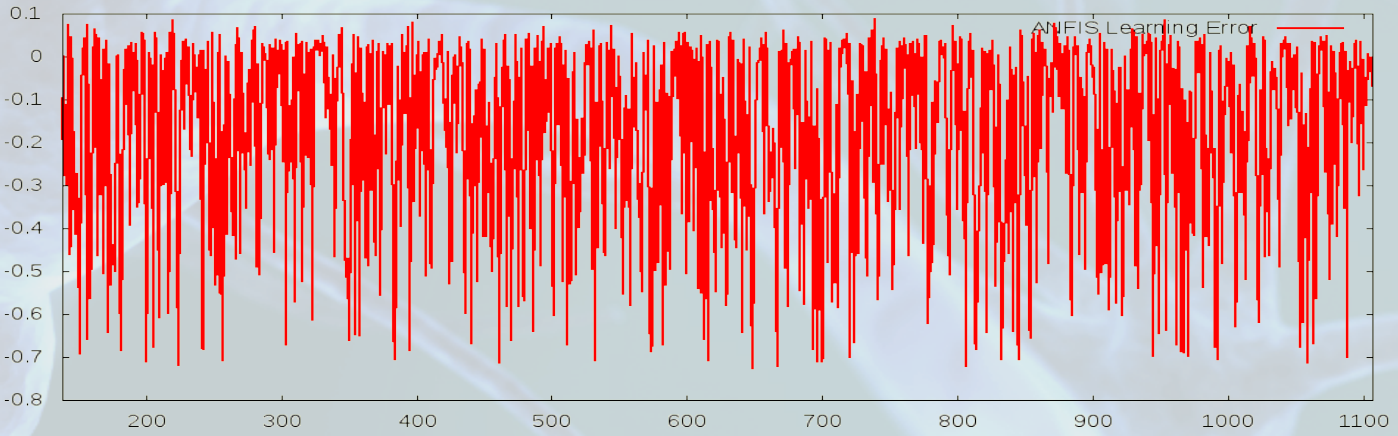
N.Bruno

T = 2
N = 4

random

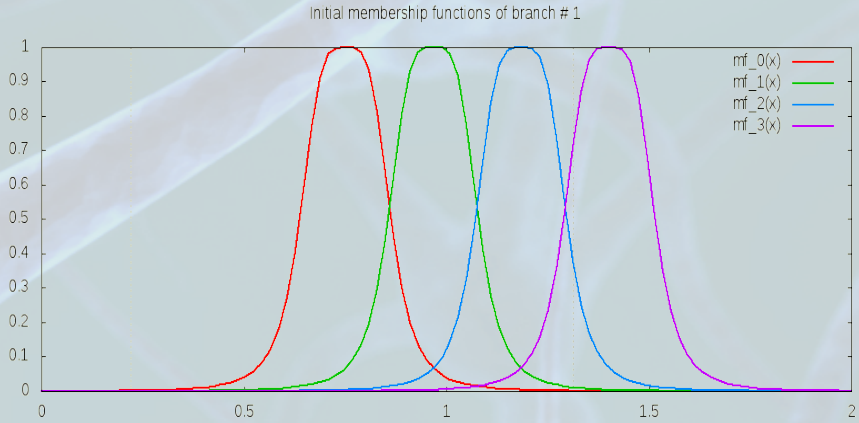
error ~
horrible

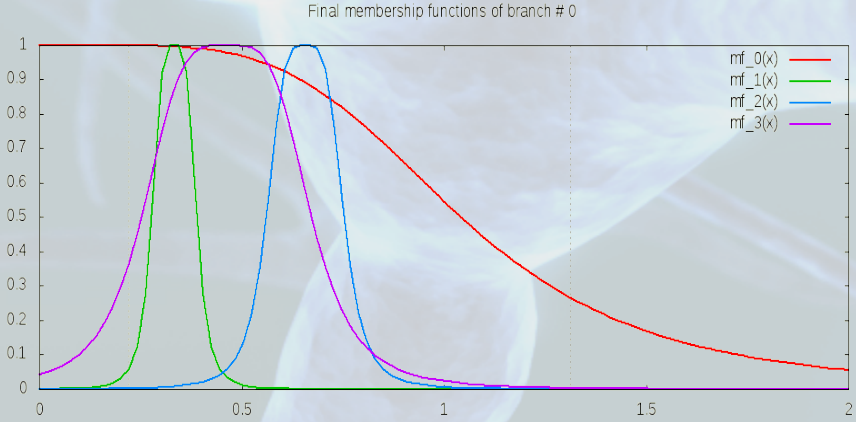


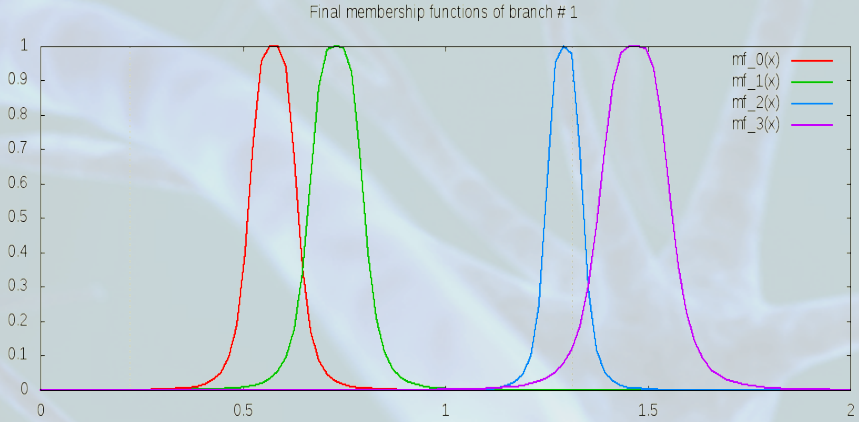


Redes Neuronales: ANFIS

N.Bruno random T=2 N=4



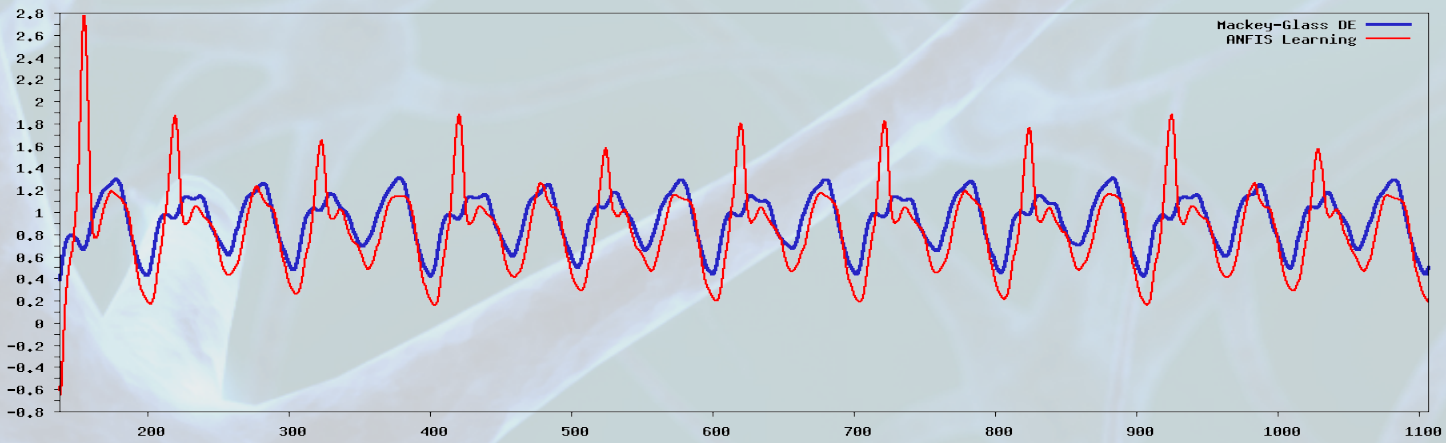




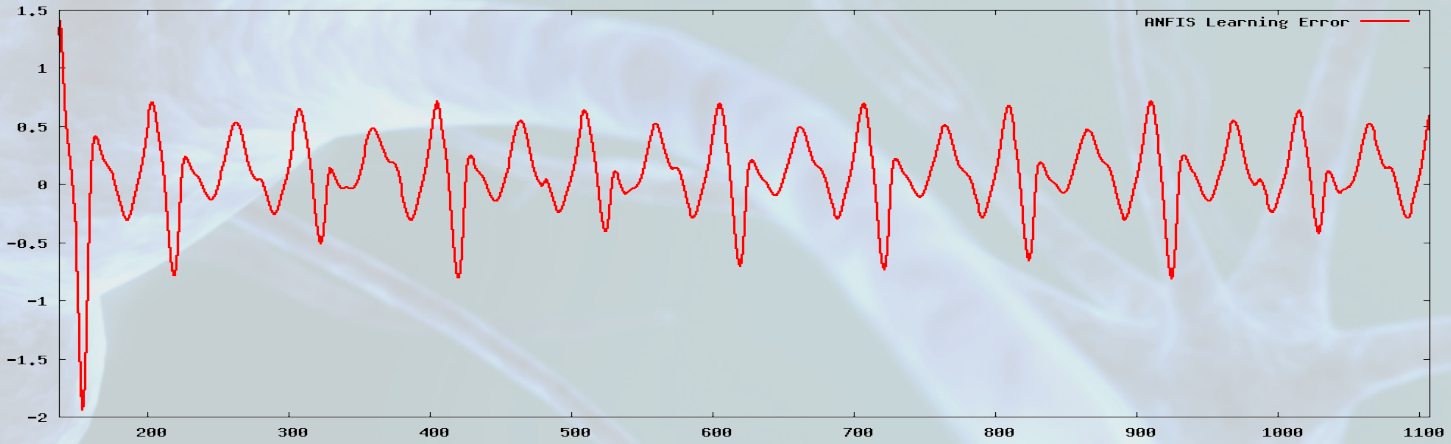
Redes Neuronales: ANFIS

R.Jang

T = 2
N = 4



error ~
[-0.8 , 0.7]



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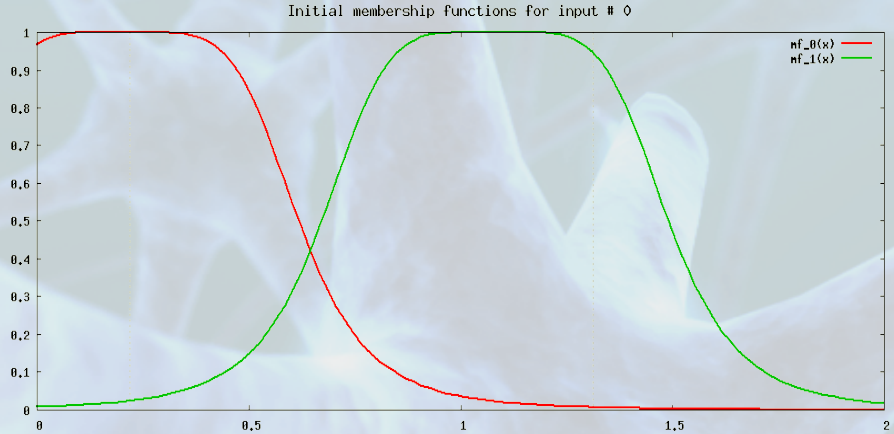
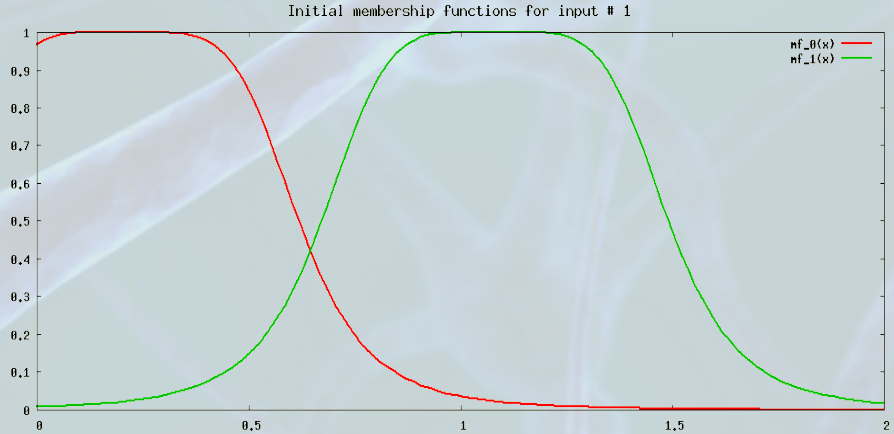
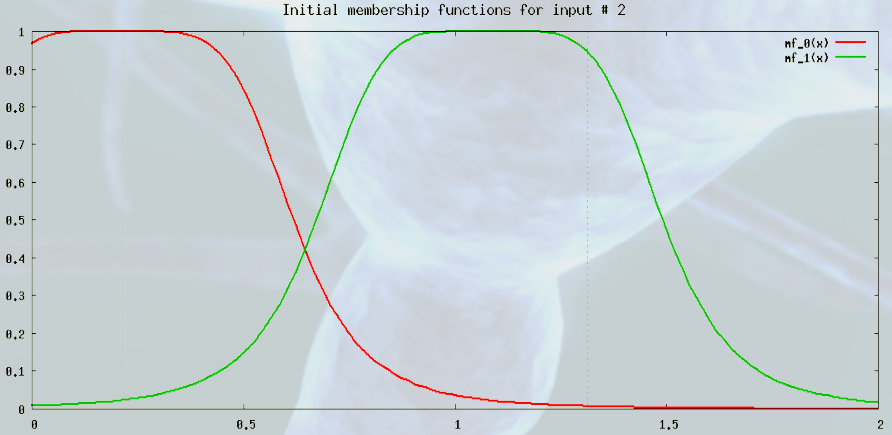
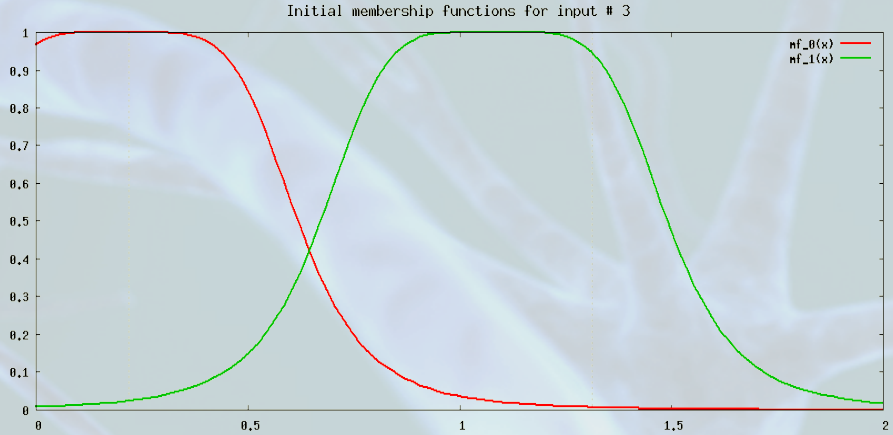
T=2 N=4









Redes Neuronales: ANFIS

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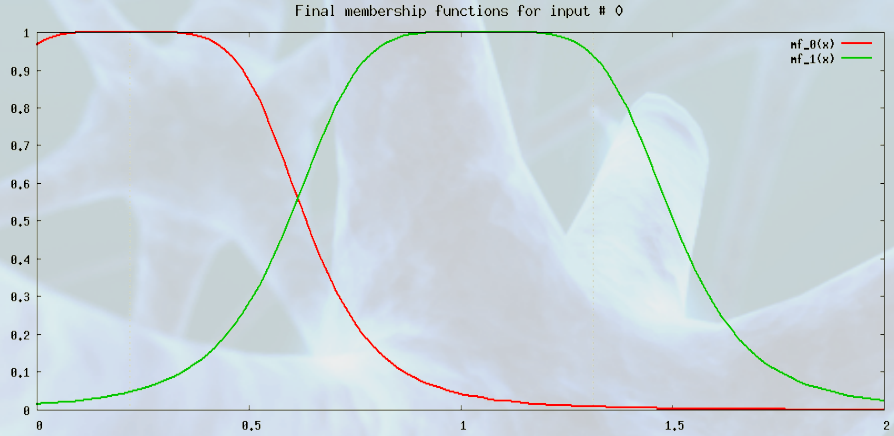
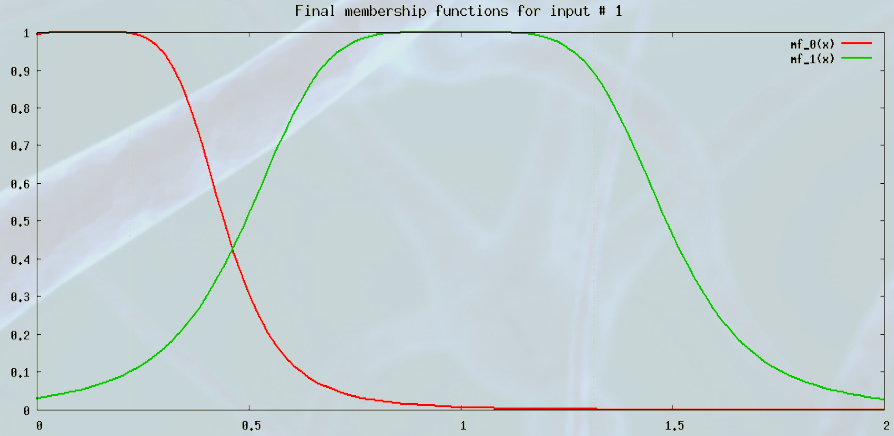
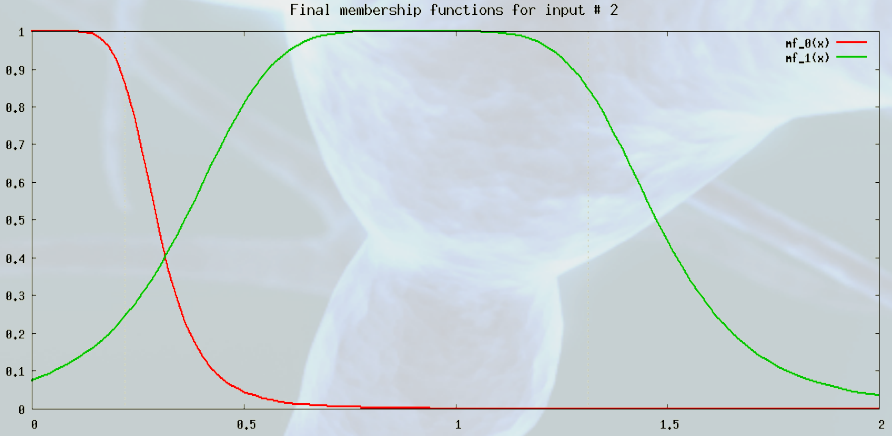
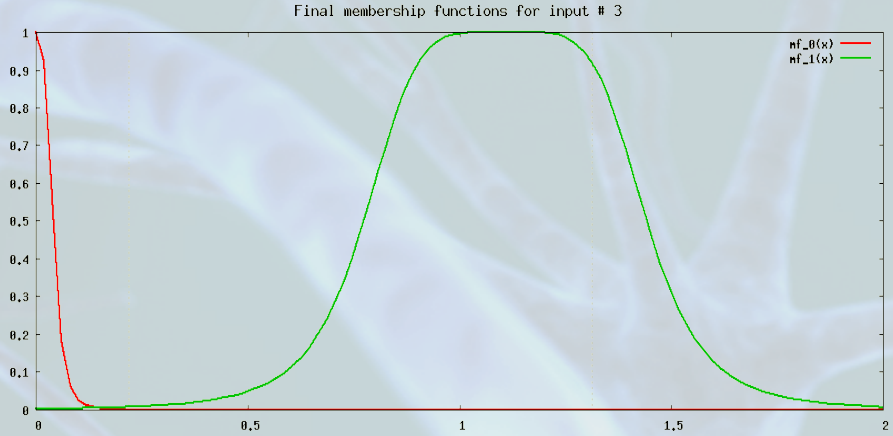
T=2 N=4









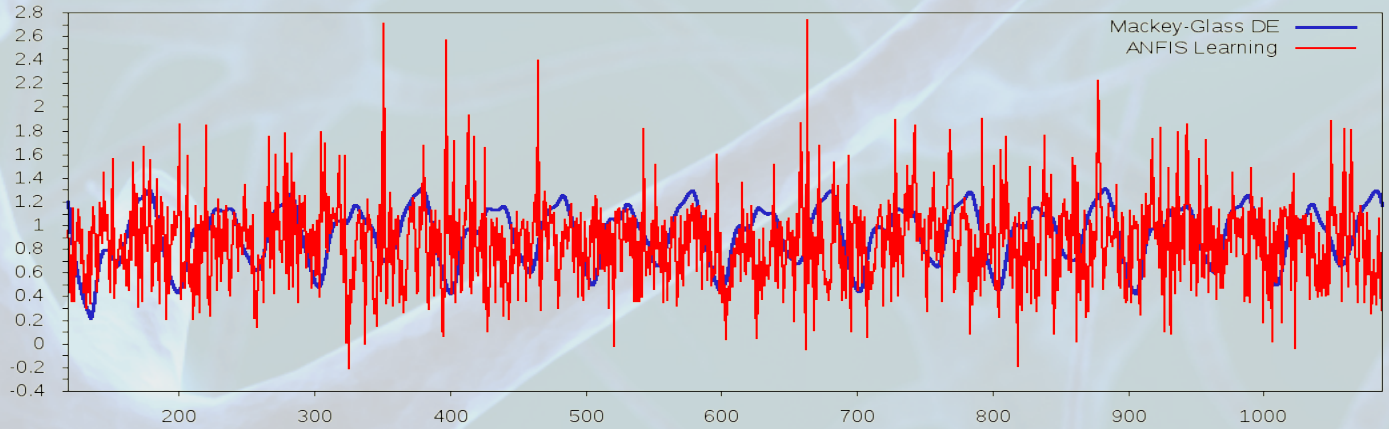
Redes Neuronales: ANFIS

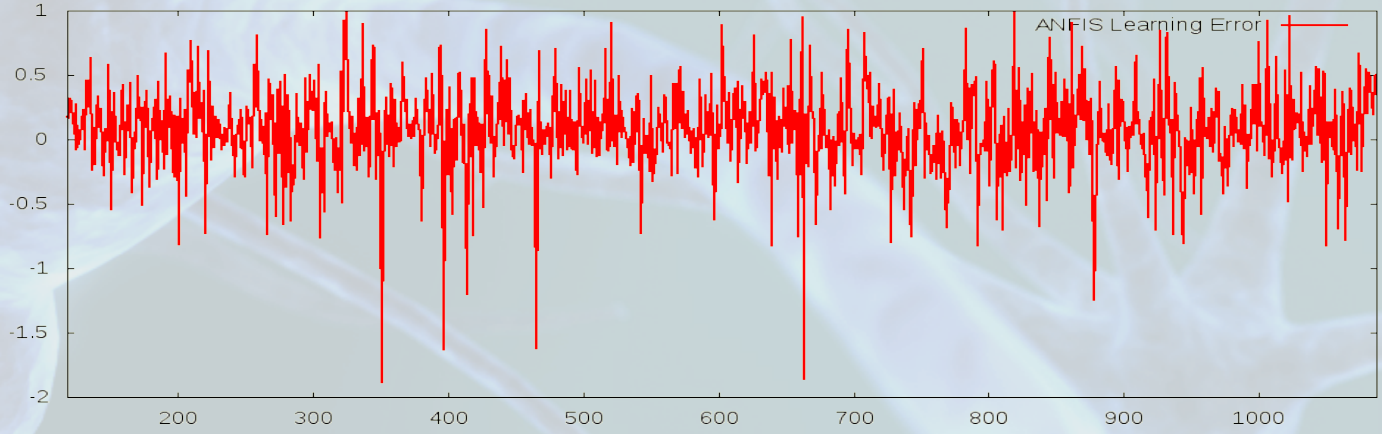
R.Jang

T = 2
N = 4

random

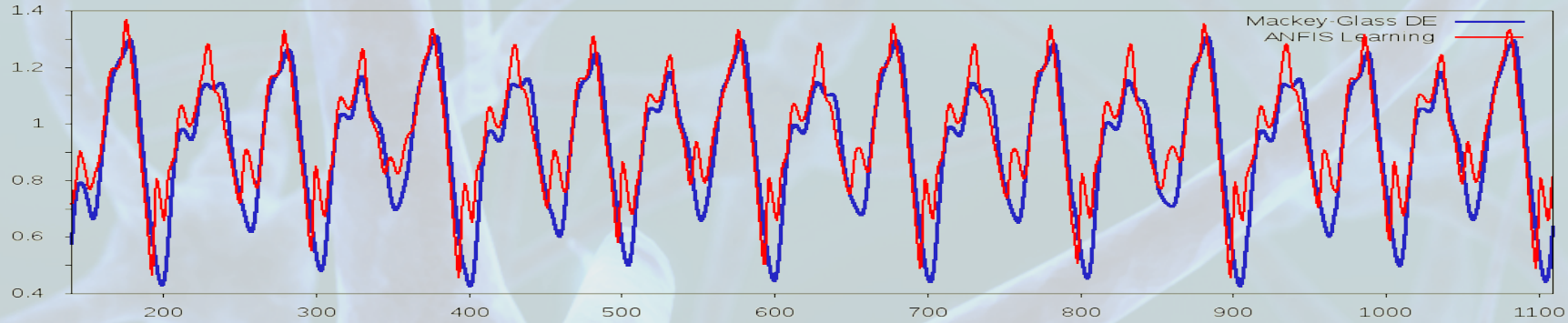
error ~ horrible



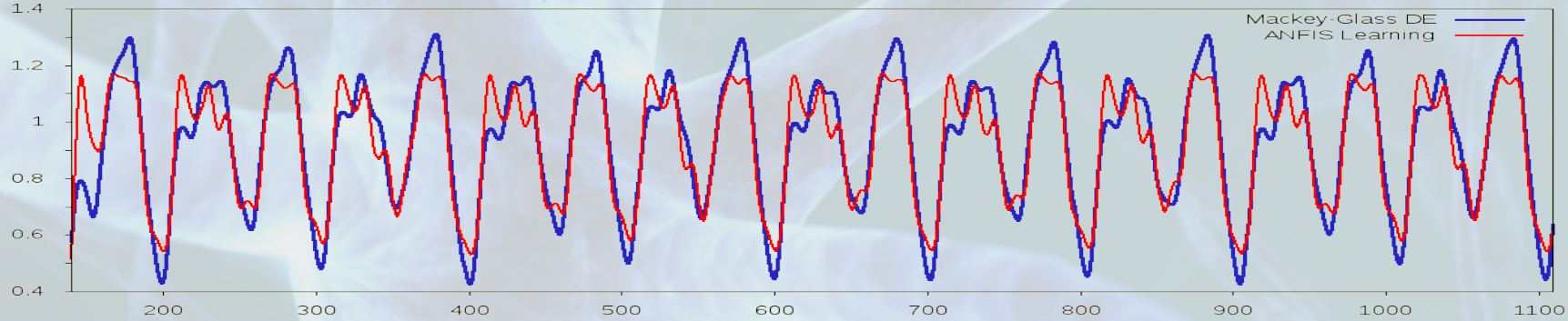


Redes Neuronales: ANFIS

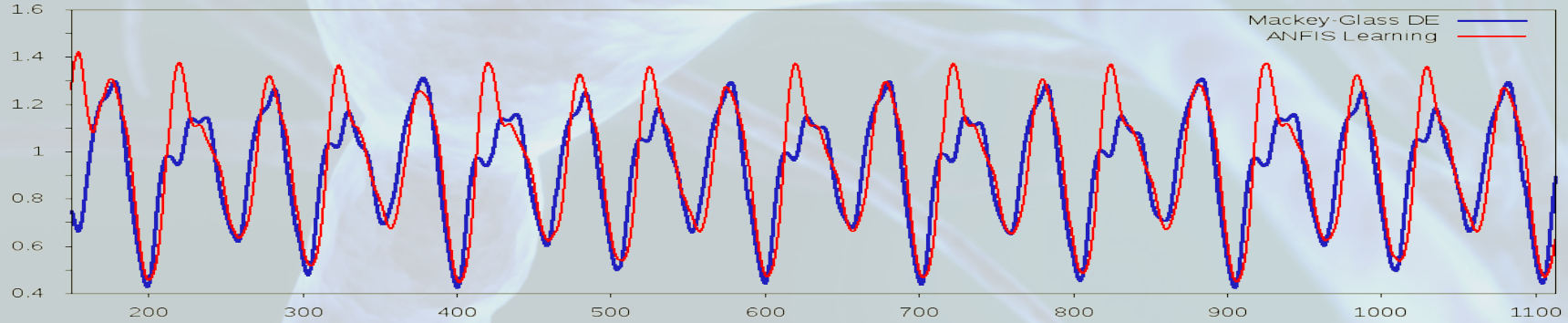
N.Bruno



T = 3
N = 4



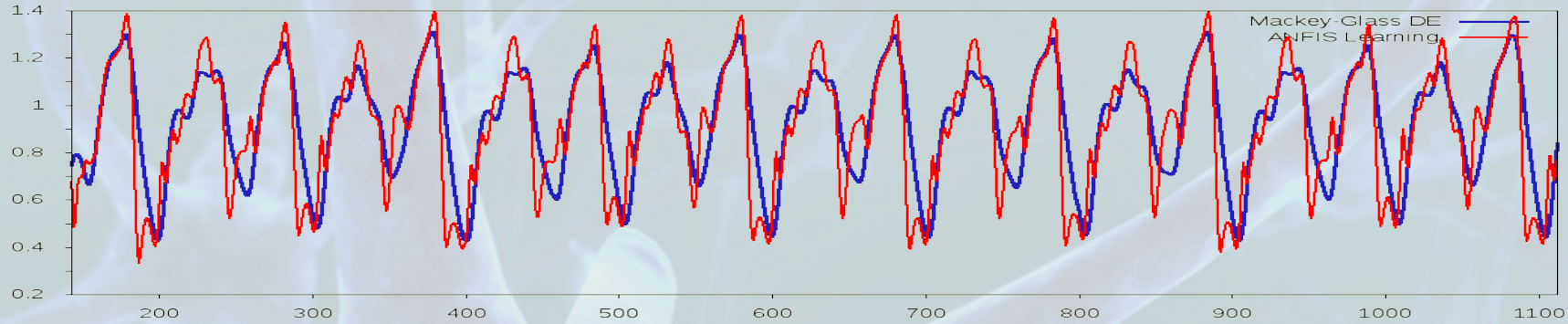
T = 1
N = 4



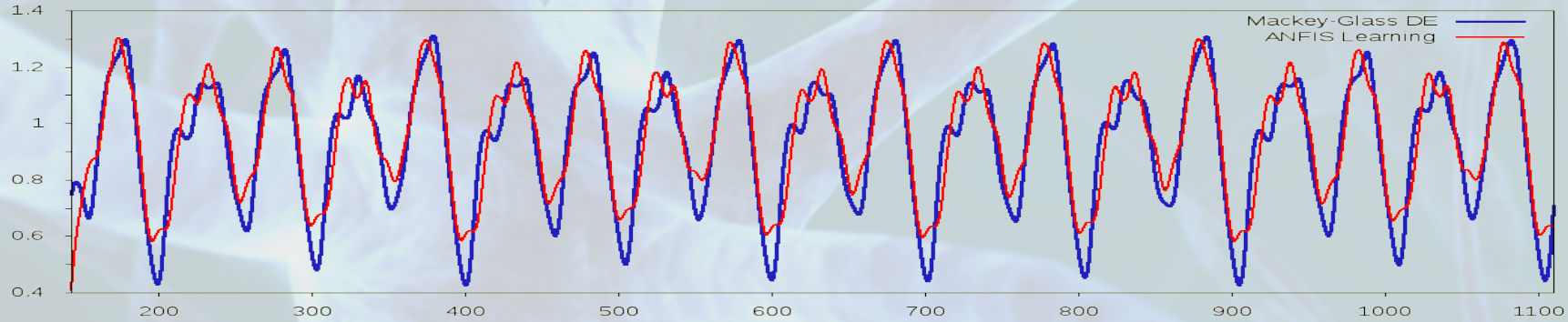
T = 2
N = 5

Redes Neuronales: ANFIS

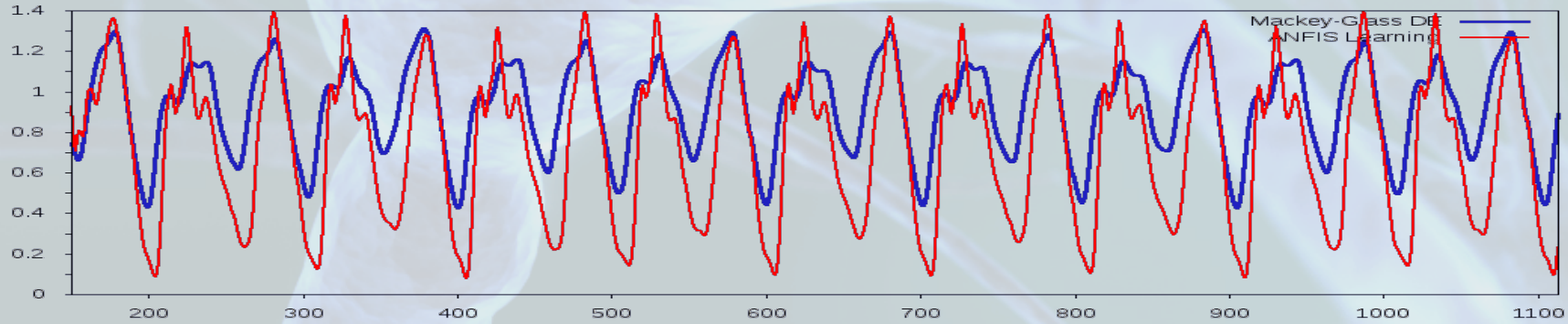
R.Jang



T = 3
N = 4



T = 1
N = 4



T = 2
N = 5

Bibliografía:

- J.R. Jang ; *ANFIS: Adaptive-Network-Based Fuzzy Inference System* ; IEEE Trans. on Systems, Man & Cybernetics ; Vol. 23, No 3 ; pp. 666-686 ; 1993
- N. Bruno ; *Sistemas de inferencia difusos basados en redes neuroadaptativas* ; Universidad de Murcia, Facultad de Informática ; 1999
- J. Hertz et al. ; *Introduction to the theory of neural computation* ; Santa Fe institute ; Perseus Books Publishing ; pp. 90-156 ; 1991