

# Neural Network, Genetic Algorithm and Composite Material

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05-25-2020

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A vertical stack of four colored rectangles representing memory segments. From top to bottom: a large light green rectangle labeled 'Heap', a thin light blue rectangle, a medium blue rectangle labeled 'Stack', and a large light red rectangle labeled 'Instruction'.

Heap

Stack

Instruction

1. Genetic Algorithm for Multimodal Problem(Solved)
2. Neural Network Design(Solved)
3. Composite Material(Unsolved)

$$sh(d_{i,j}) = \begin{cases} 1 - \left(\frac{d_{i,j}}{\sigma_{sh}}\right)^{\alpha_{sh}} & \text{if } d_{i,j} < \sigma_{sh} \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

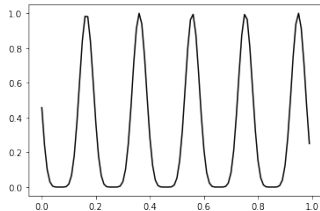
where  $d_{i,j}$  denotes distance between two individuals,  $\alpha_{sh}$  is a constant number and  $\sigma_{sh}$  is the radius of niches.

**Table 1:** GA Parameters

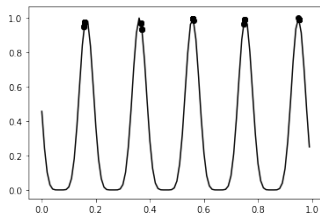
parameter	value
generation	50
length	16
encoding	binary encoding
cross	one-point
mutation	none

Target Function

$$f_1(x) = \sin^6(5.1\pi x + 0.5) \quad (2)$$



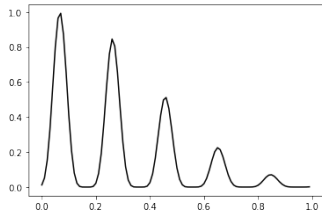
**Figure 1:** Target Function



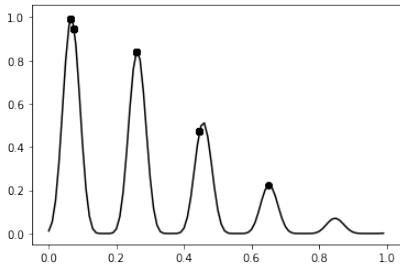
**Figure 2:** Result

Target Function

$$f_2(x) = f_1(x) \cdot e^{\left[ -4 \ln 2 \frac{(x-0.086)^2}{0.8^2} \right]} \quad (3)$$



**Figure 3:** Target Function

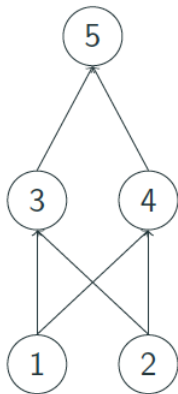


**Figure 4:** Result

# Neural Network Design

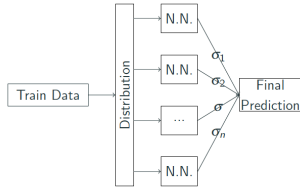
from unit:	1	2	3	4	5	bias	code
to unit:							
1	0	0	0	0	0	0	000000
2	0	0	0	0	0	0	000000
3	L	L	0	0	0	L	110001
4	L	L	0	0	0	L	110001
5	0	0	L	L	0	L	001101

**Figure 5:** Bit String Genotype

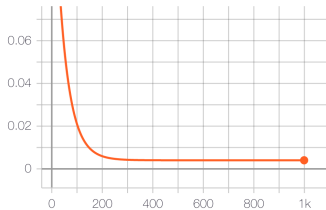


**Figure 6:** Architecture

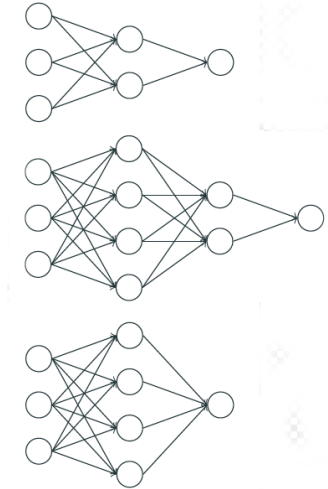
# Neural Network Design



**Figure 7:** Adaboost



**Figure 8:** Train Process of Neural Network with Toy Data

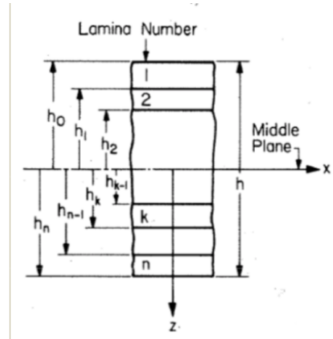


**Figure 9:** Topology of Neural Network



# Composite Material

- How to get these three things work together ?



**Figure 10:** Composite Material