Neural Network, Genetic Algorithm and Composite Material

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05-25-2020

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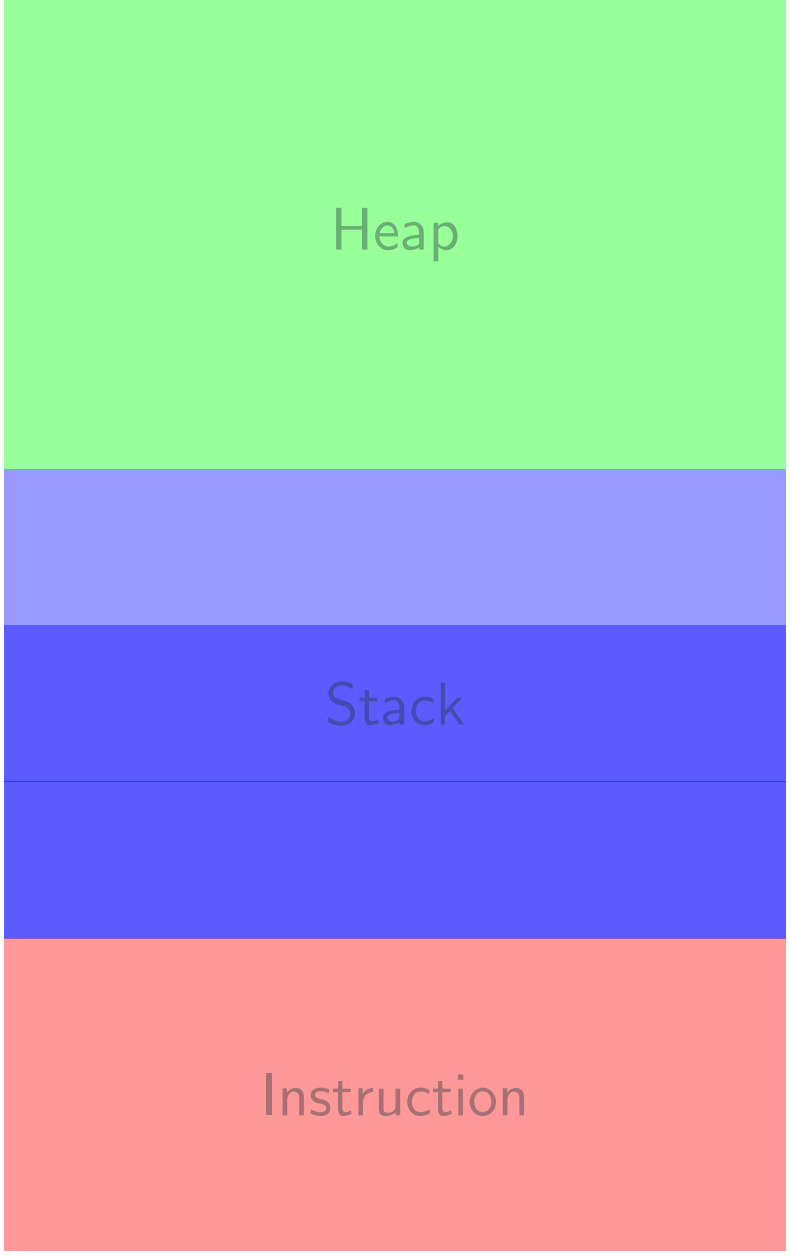
Heap
Stack
Instruction

Content

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

Genetic Algorithm

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

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

Table 1: GA Parameters

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

Genetic Algorithm

Target Function

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

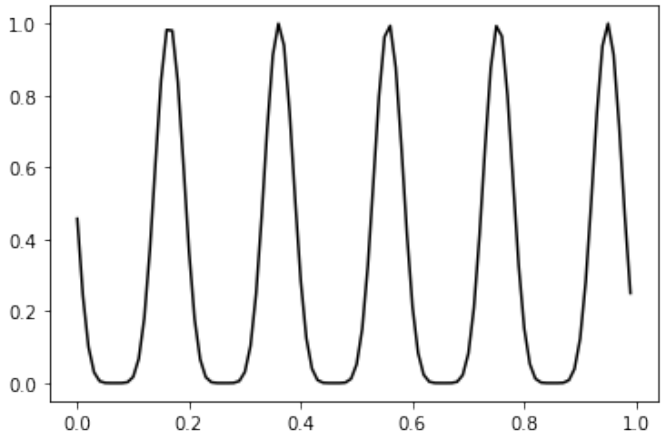

Figure 1: Target Function

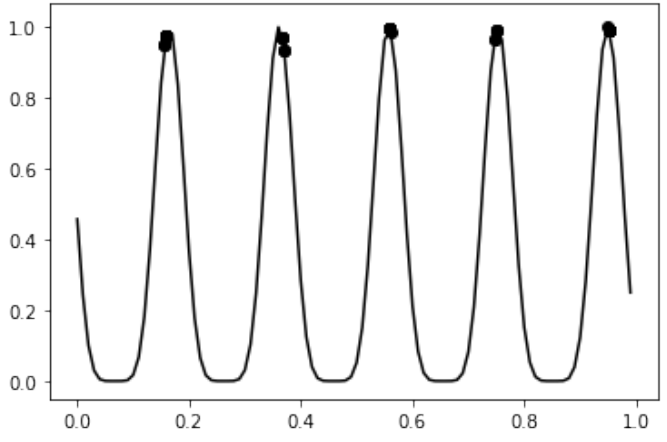

Figure 2: Result

Genetic Algorithm

Target Function

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

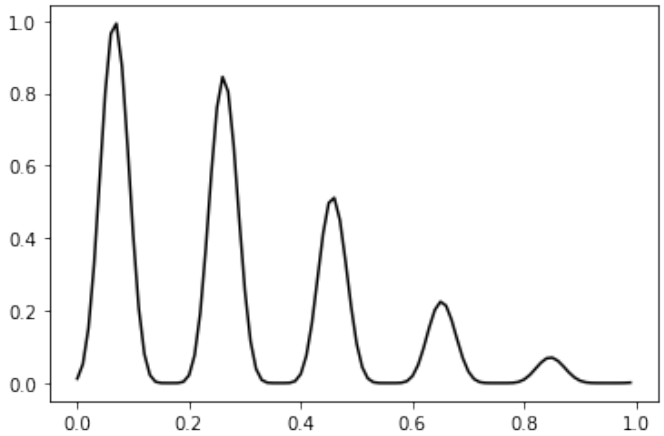

Figure 3: Target Function

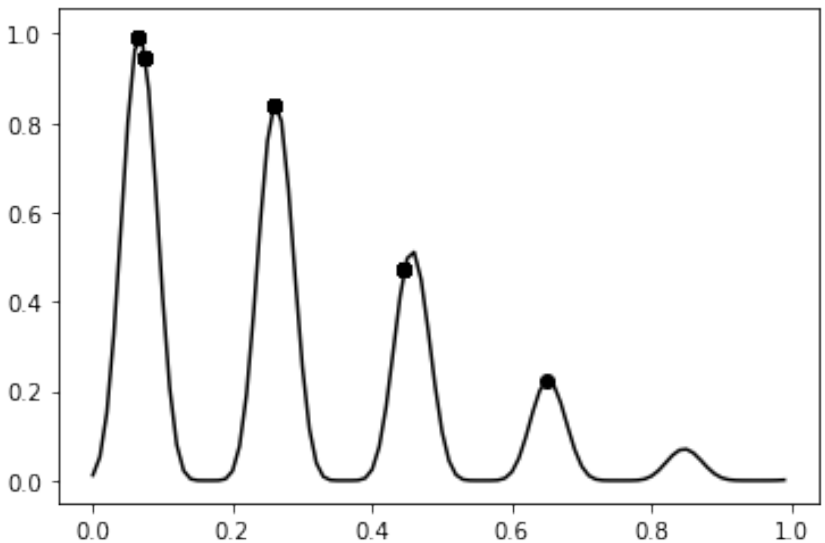

Figure 4: Result

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

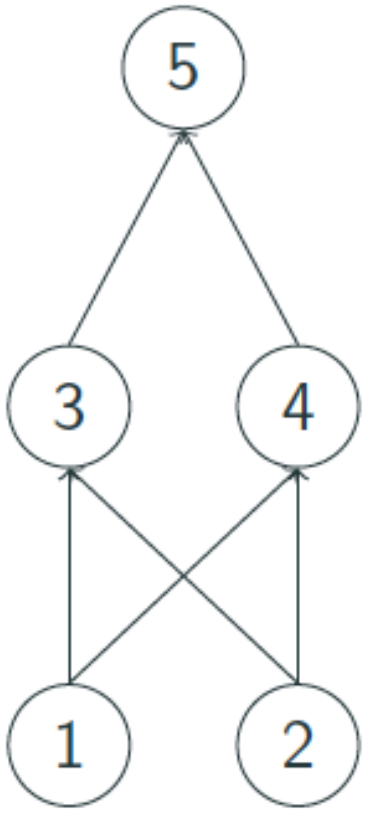

Figure 6: Architecture

Neural Network Design

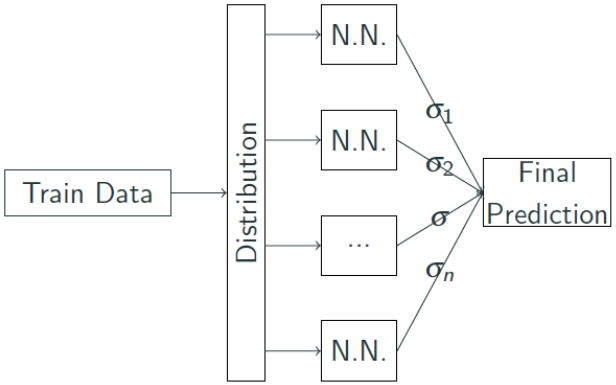

Figure 7: Adaboost

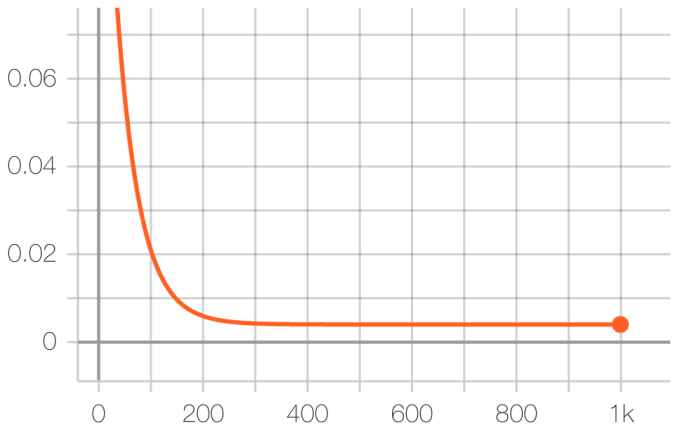

Figure 8: Train Process of Neural Network with Toy Data

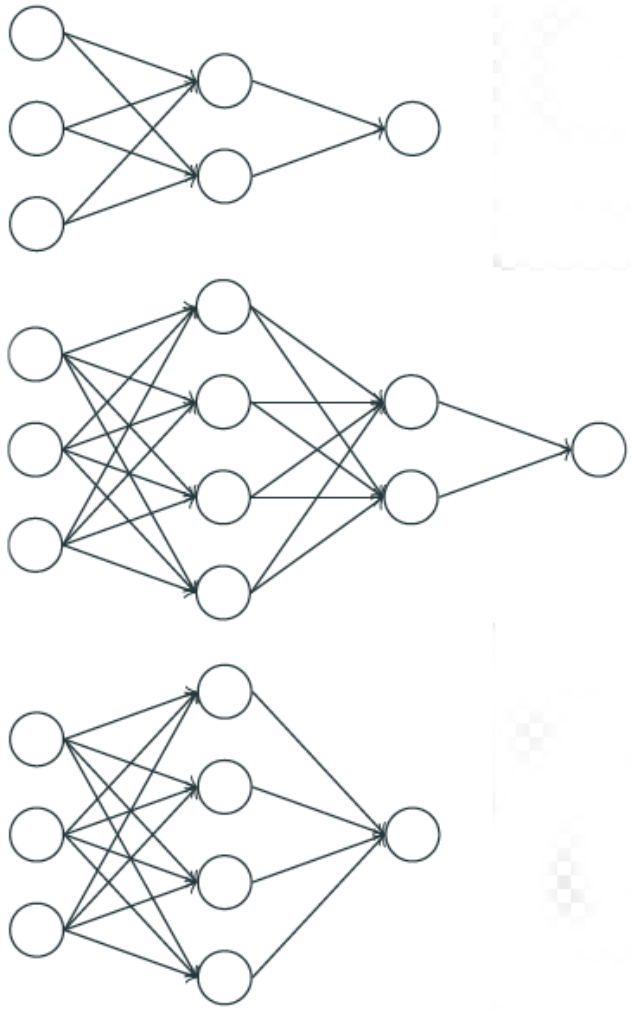

Figure 9: Topology of Neural Network

Composite Material

- How to get these three things work together ?

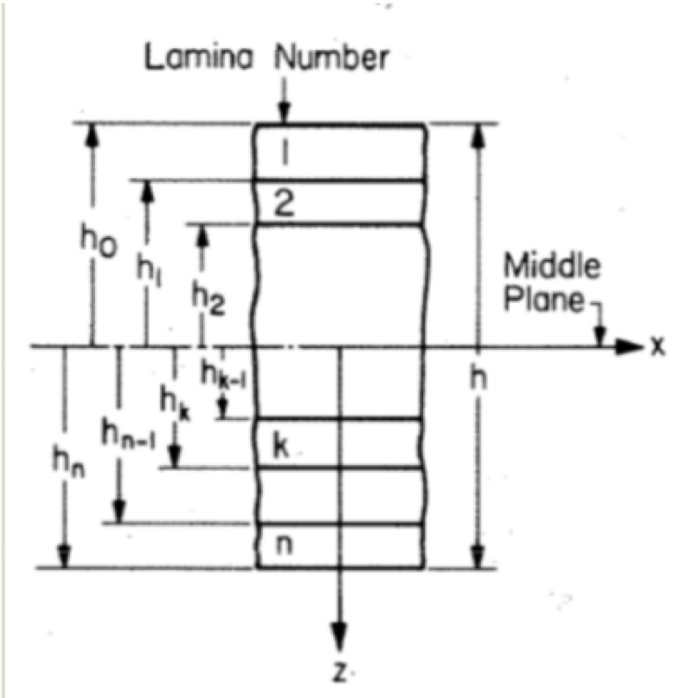

Figure 10: Composite Material