Modeling of angle ply laminates using artificial neural network

Huiyao Zhang

12-10-2020

Kyoto Institue of Technology

2. Neural Work

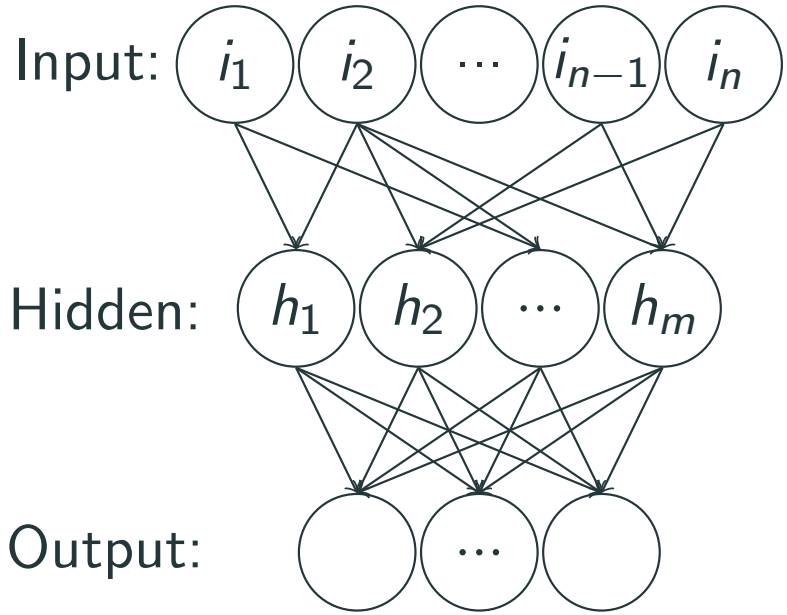
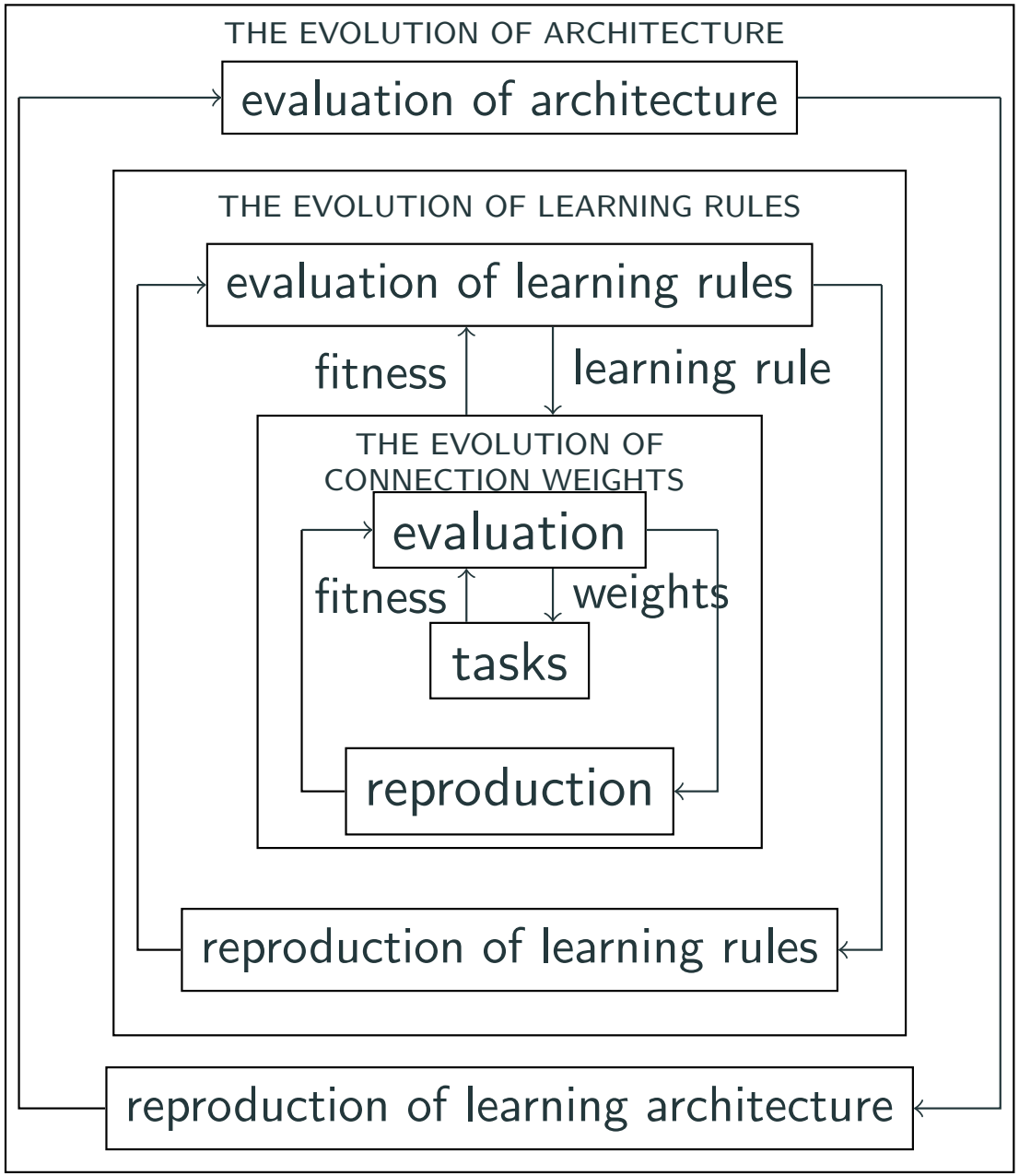


Figure 1: Neural Network Model

2. Genetic Algorithm



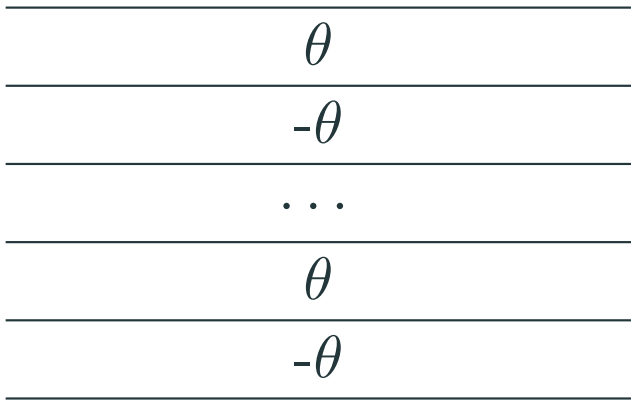


Figure 3: Model for Angle ply laminate

$$\begin{bmatrix} N_x \\ N_y \\ N_{xy} \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} & A_{16} \\ A_{12} & A_{22} & A_{26} \\ A_{16} & A_{26} & A_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_x^0 \\ \varepsilon_y^0 \\ \gamma_{xy}^0 \end{bmatrix} + \begin{bmatrix} B_{11} & B_{12} & B_{16} \\ B_{11} & B_{12} & B_{16} \\ B_{16} & B_{26} & B_{66} \end{bmatrix} \begin{bmatrix} k_x \\ k_y \\ k_{xy} \end{bmatrix}$$

$$\begin{bmatrix} M_x \\ M_y \\ M_{xy} \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & B_{16} \\ B_{12} & B_{22} & B_{26} \\ B_{16} & B_{26} & B_{66} \end{bmatrix} \begin{bmatrix} \varepsilon_x^0 \\ \varepsilon_y^0 \\ \gamma_{xy}^0 \end{bmatrix} + \begin{bmatrix} D_{11} & D_{12} & D_{16} \\ D_{11} & D_{12} & D_{16} \\ D_{16} & D_{26} & D_{66} \end{bmatrix} \begin{bmatrix} k_x \\ k_y \\ k_{xy} \end{bmatrix} \quad (1)$$

2. Methdology

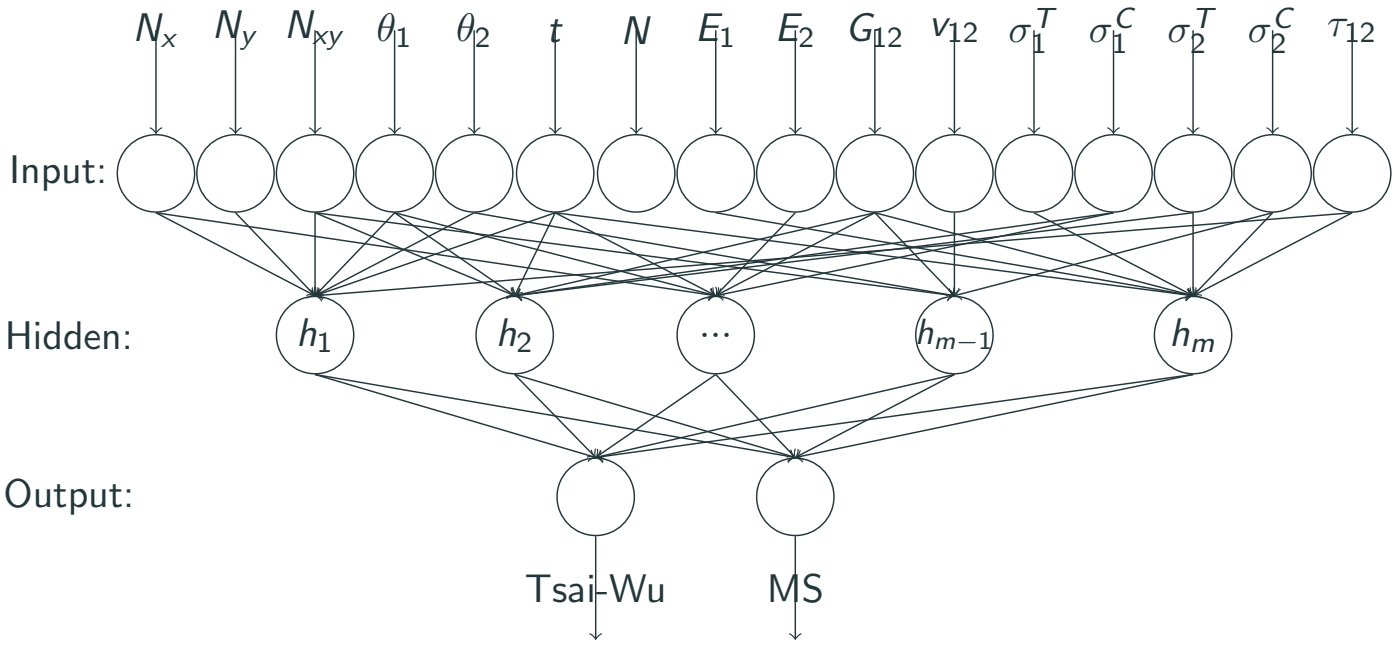


Figure 4: Neural Network Model

3. Implementation: Data Preparation

Input				Output	
Load	Laminate Structure	Material Property	Failure Property	MS	Tsai-Wu
120,5,0	10,-10,8,1.27	38.6,8.27,0.26,4.14	1062.0,610.0,31,118,72	0.068	0.062
120,5,0	10,-10,2,1.27	38.6,8.27,0.26,4.14	1062.0,610.0,31,118,72	1.69	2.18
...	...	...	...	...	...
120,5,0	10,-10,134,1.27	38.6,8.27,0.26,4.14	1062.0,610.0,31,118,72	1.70	1.56
120,5,0	10,-10,8,1.27	181,10.3,0.28,7.17	1500.0,1500.0,40,246,68	0.072	0.024

4. Implementation: Neural Network