Neural Architecture Design

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Content

Original Ideas

1. Building Blocks of Neural Network
2. Multiple Transfer Functions dsdsd

Evolutionary Design of ANN

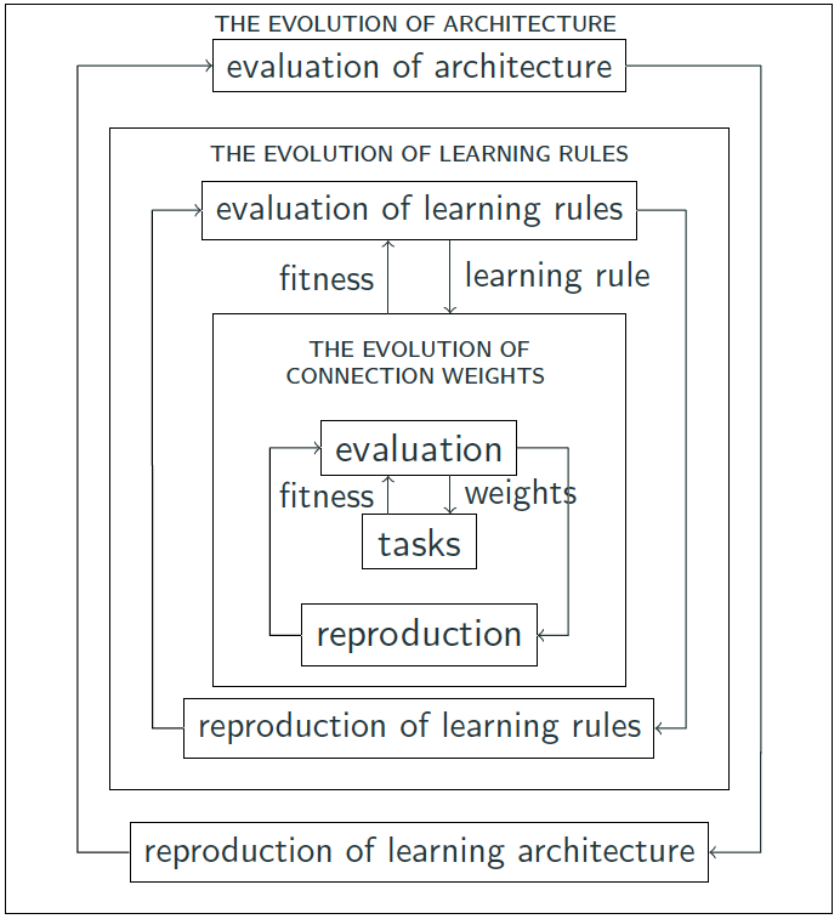


Figure 1: General Search Architecture

[1] Geoffrey F Miller, Peter M Todd, and Shailesh U Hegde. "Designing Neural Networks using Genetic Algorithms.". In: *ICGA*. vol. 89. 1989. pp. 379–384.

Building Blocks

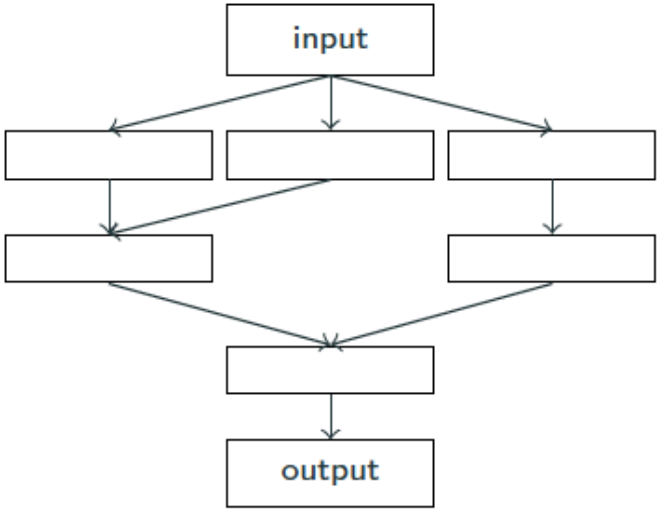


Figure 2: Normal Cell

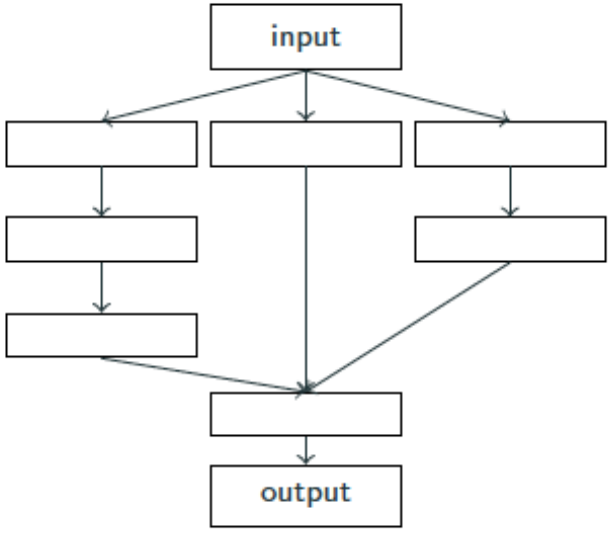


Figure 3: Reduction Cell

2

[2]Barret Zoph and Quoc V Le. "Neural architecture search with reinforcement learning". In: *arXiv preprint arXiv:1611.01578* (2016).

Stack Method

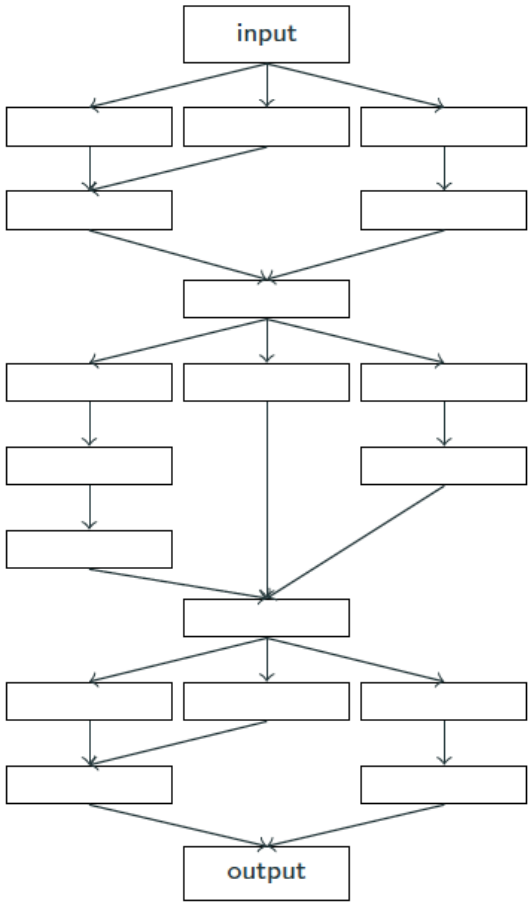


Figure 4: Chained Neural Network

3

[3] Thomas Elsken, Jan Hendrik Metzen, and Frank Hutter. "Neural architecture search: A survey". In: *arXiv preprint arXiv:1808.05377* (2018).

Stack Method

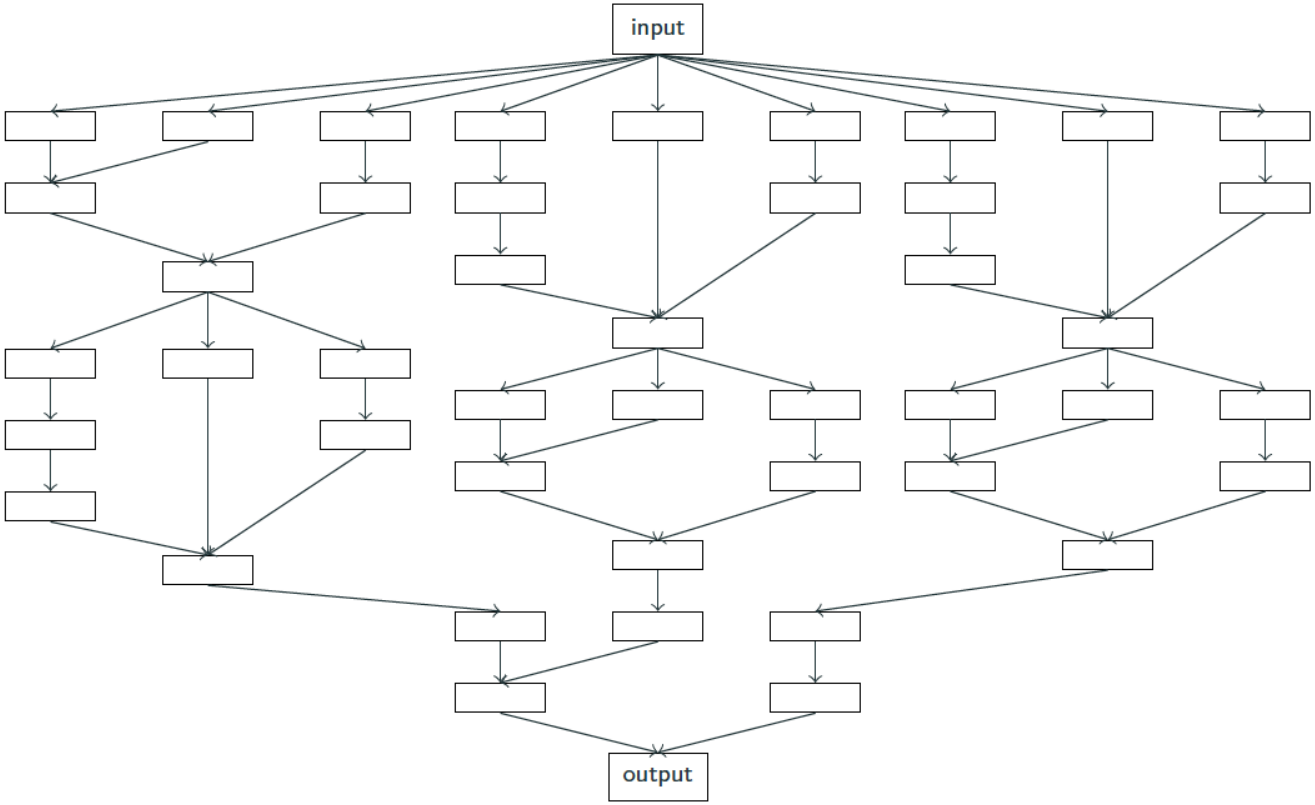


Figure 5: Multi-branch Neural Network

Transfer Function

1. Sigmoid

$$f(x) = \frac{1}{1 + e^{-\beta x}} \tag{1}$$

2. Piecewise Linear

$$f(x) = \begin{cases} 0 & \text{if } x \leq x_{\min} \\ mx + b & \text{if } x_{\max} > x > x_{\min} \\ 1 & \text{if } x \geq x_{\max} \end{cases} \tag{2}$$

3. Gaussian

$$f(x) = \frac{1}{\sqrt{2\pi\sigma}} e^{\frac{-(x-\mu)^2}{2\sigma^2}} \tag{3}$$

[4]

[4] Yong Liu and Xin Yao. "Evolutionary design of artificial neural networks with different nodes". In: *Proceedings of IEEE international conference on evolutionary computation*. IEEE. 1996, pp. 670–675.

Hybrid Training

1. GA: Global Optimization
2. BP: Local Optimization asds

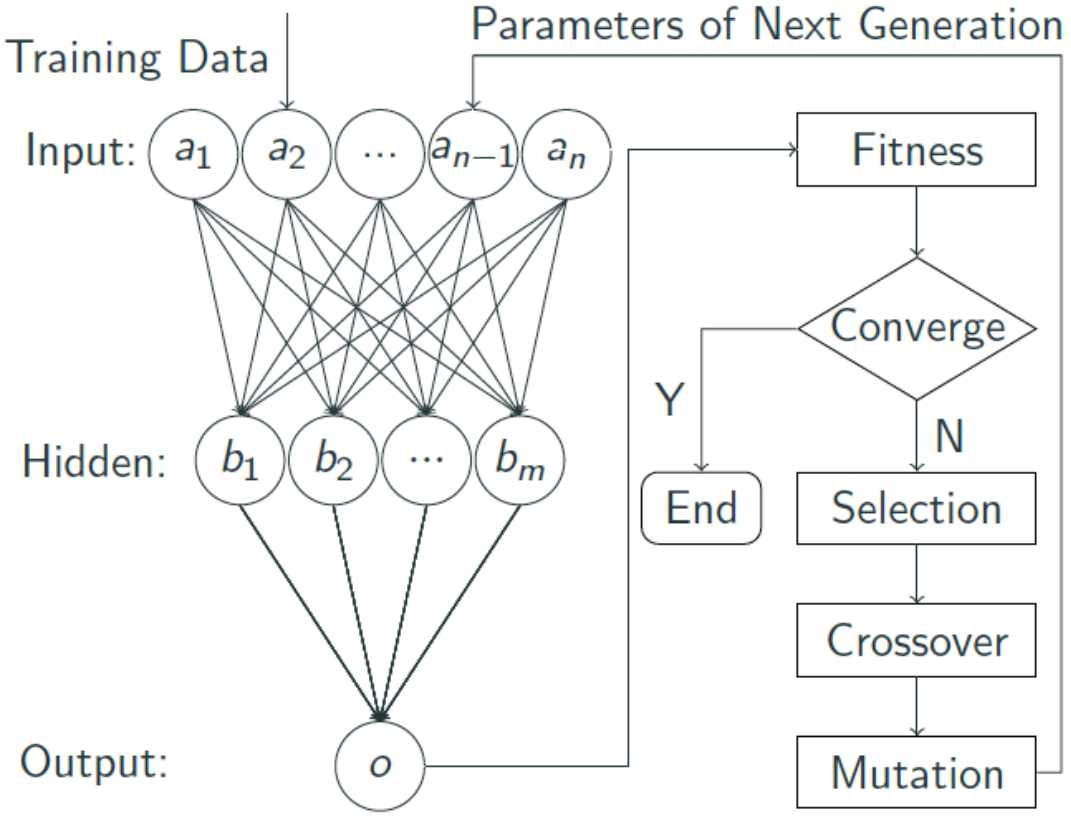
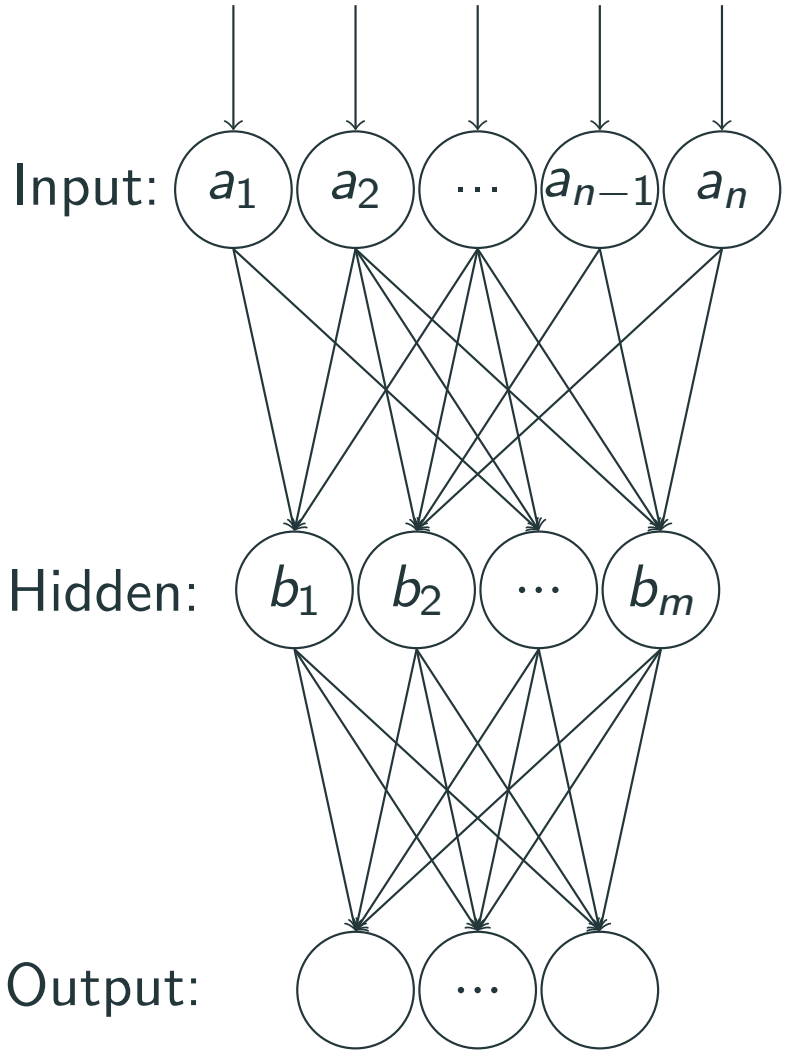
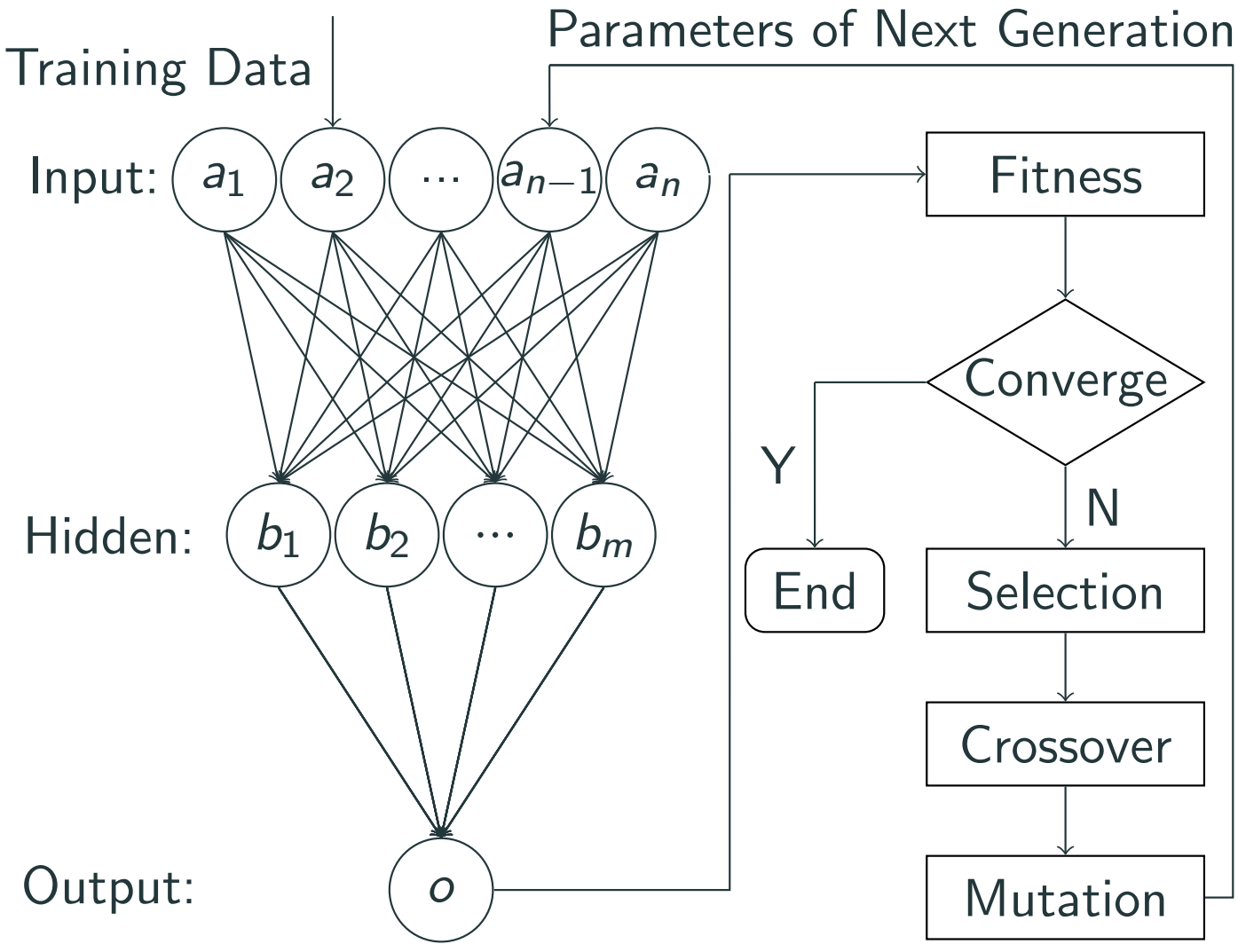
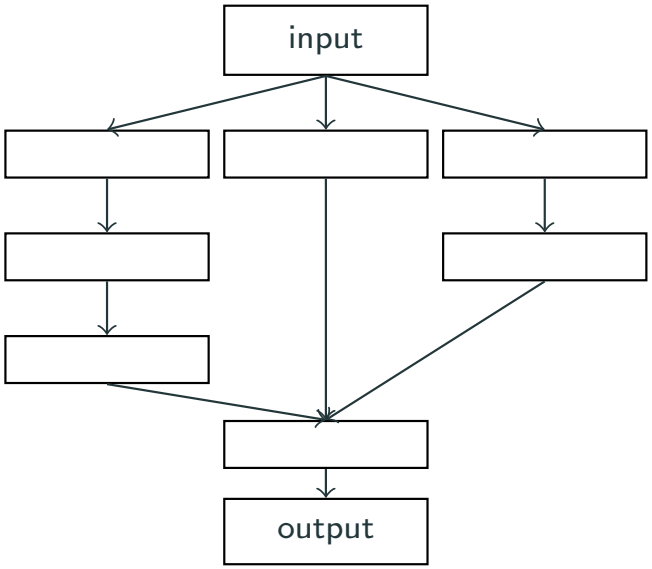
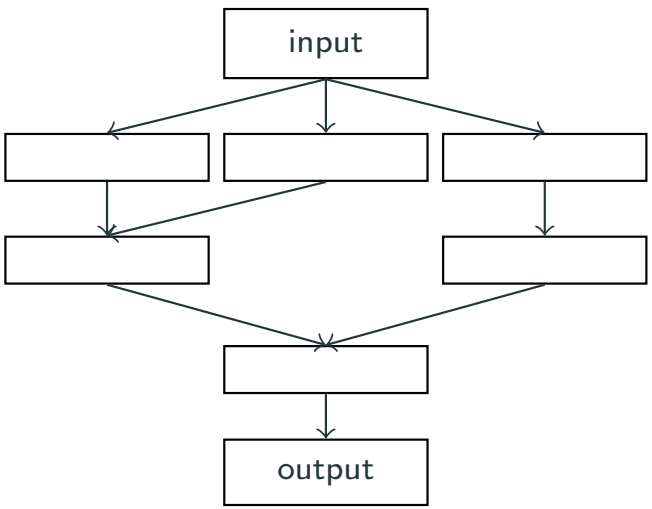


Figure 6: Hybrid Training


Input:
a_1
a_2
$\cdots$
a_{n-1}
a_n
Hidden:
b_1
b_2
$\cdots$
b_m
Output:
$\cdots$


Training Data
Parameters of Next Generation
Input:
a_1
a_2
$\cdots$
a_{n-1}
a_n
Hidden:
b_1
b_2
$\cdots$
b_m
Output:
o
Fitness
Converge
Y
N
End
Selection
Crossover
Mutation


input
output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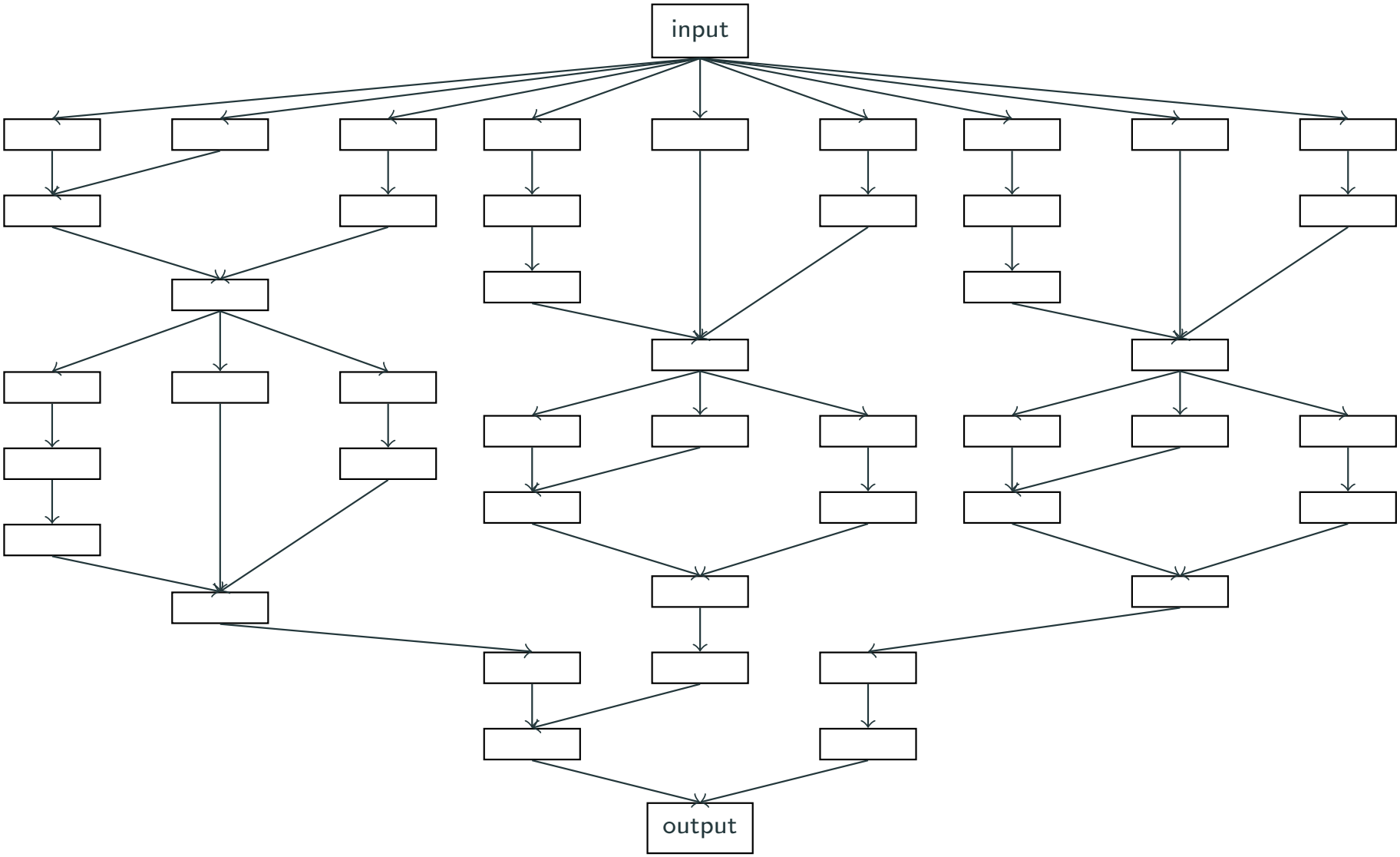
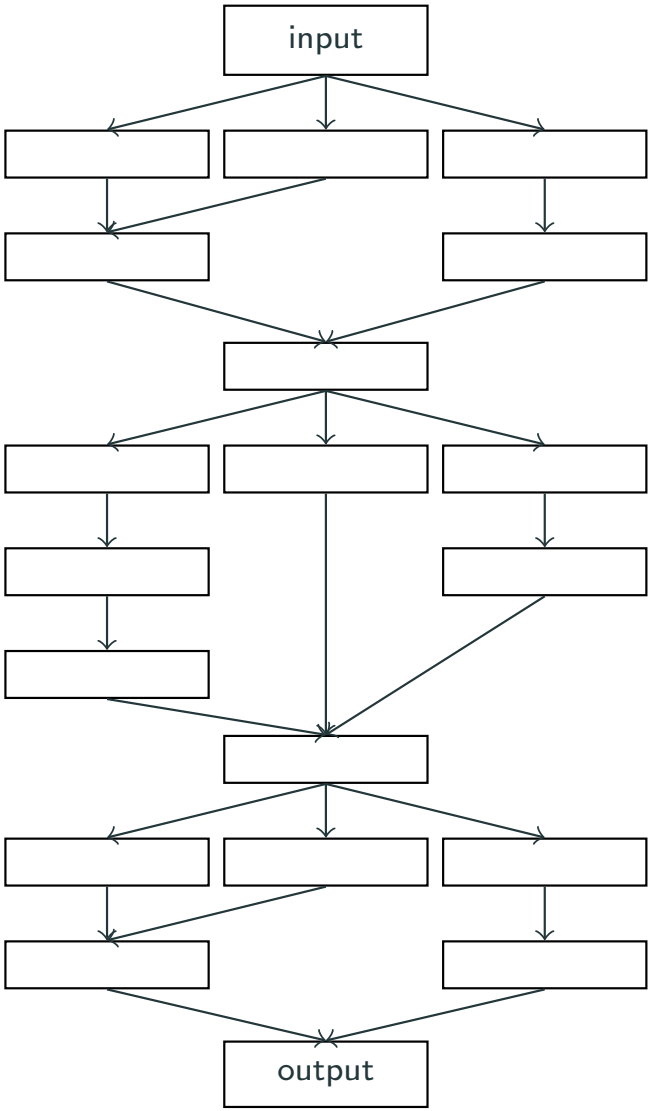
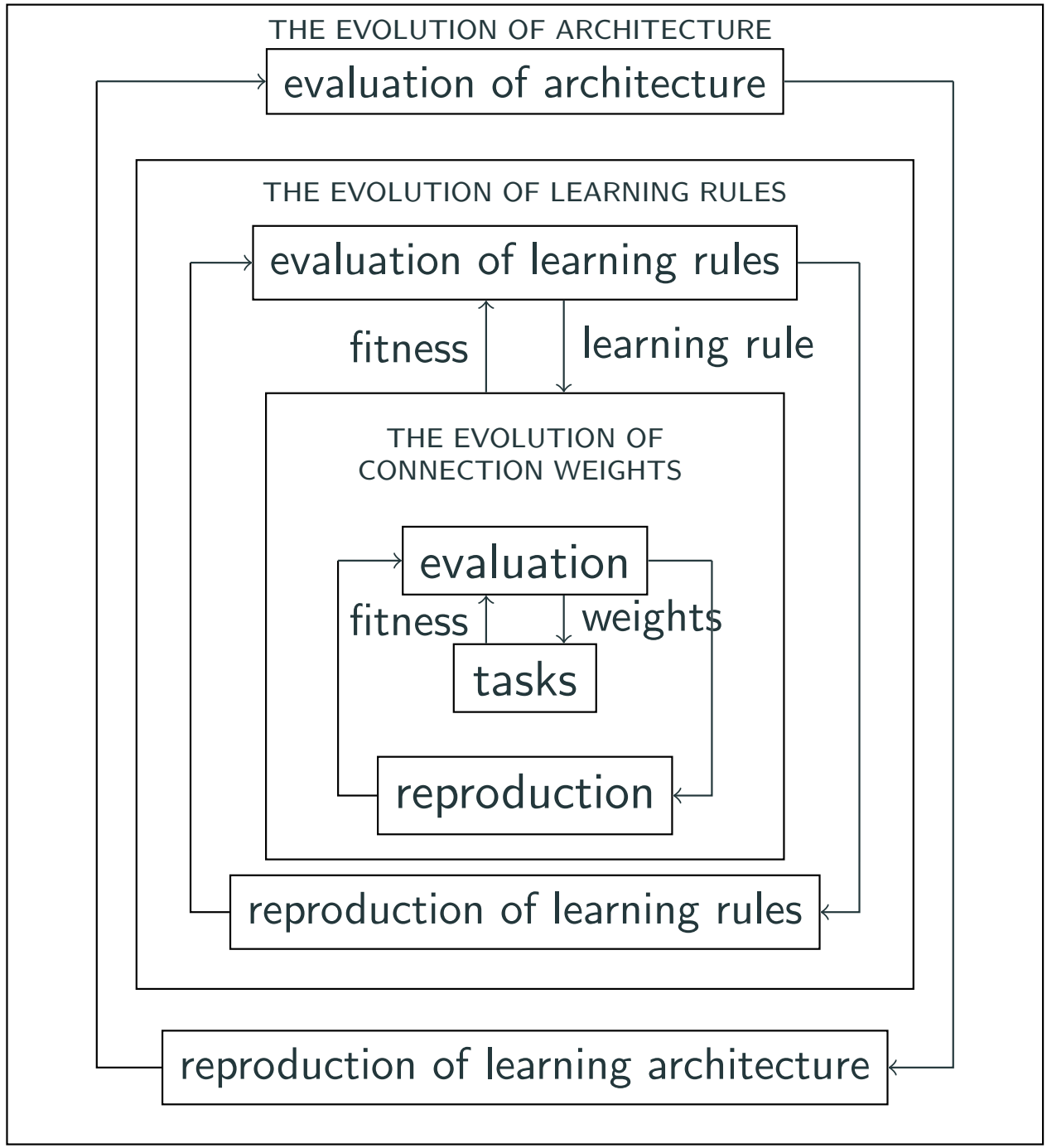
output


input
output


input
output


THE EVOLUTION OF ARCHITECTURE
evaluation of architecture
THE EVOLUTION OF LEARNING RULES
evaluation of learning rules
fitness
learning rule
THE EVOLUTION OF
CONNECTION WEIGHTS
evaluation
fitness
weights
tasks
reproduction
reproduction of learning rules
reproduction of learning architecture