

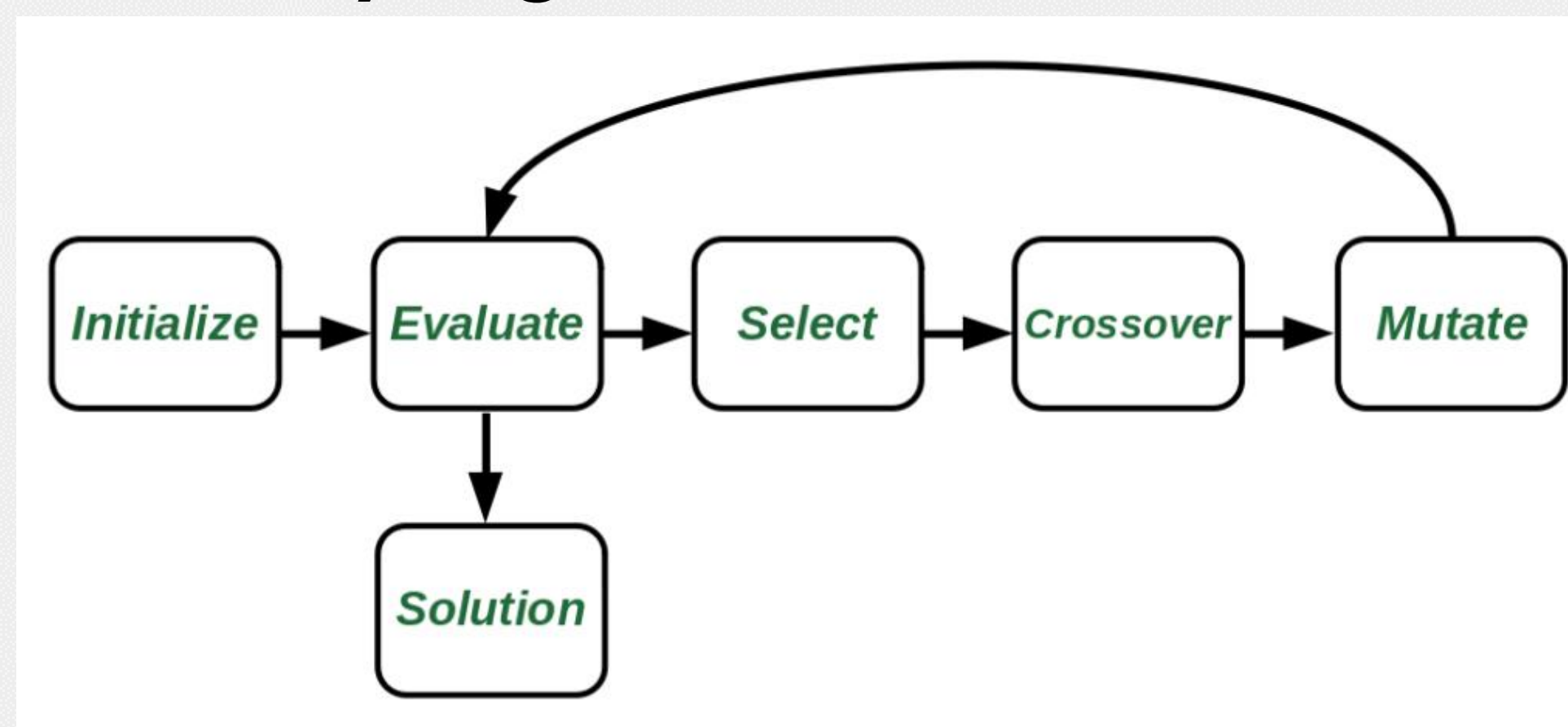


Multitasking Artificial Neural Network with Evolved Activity Dependence

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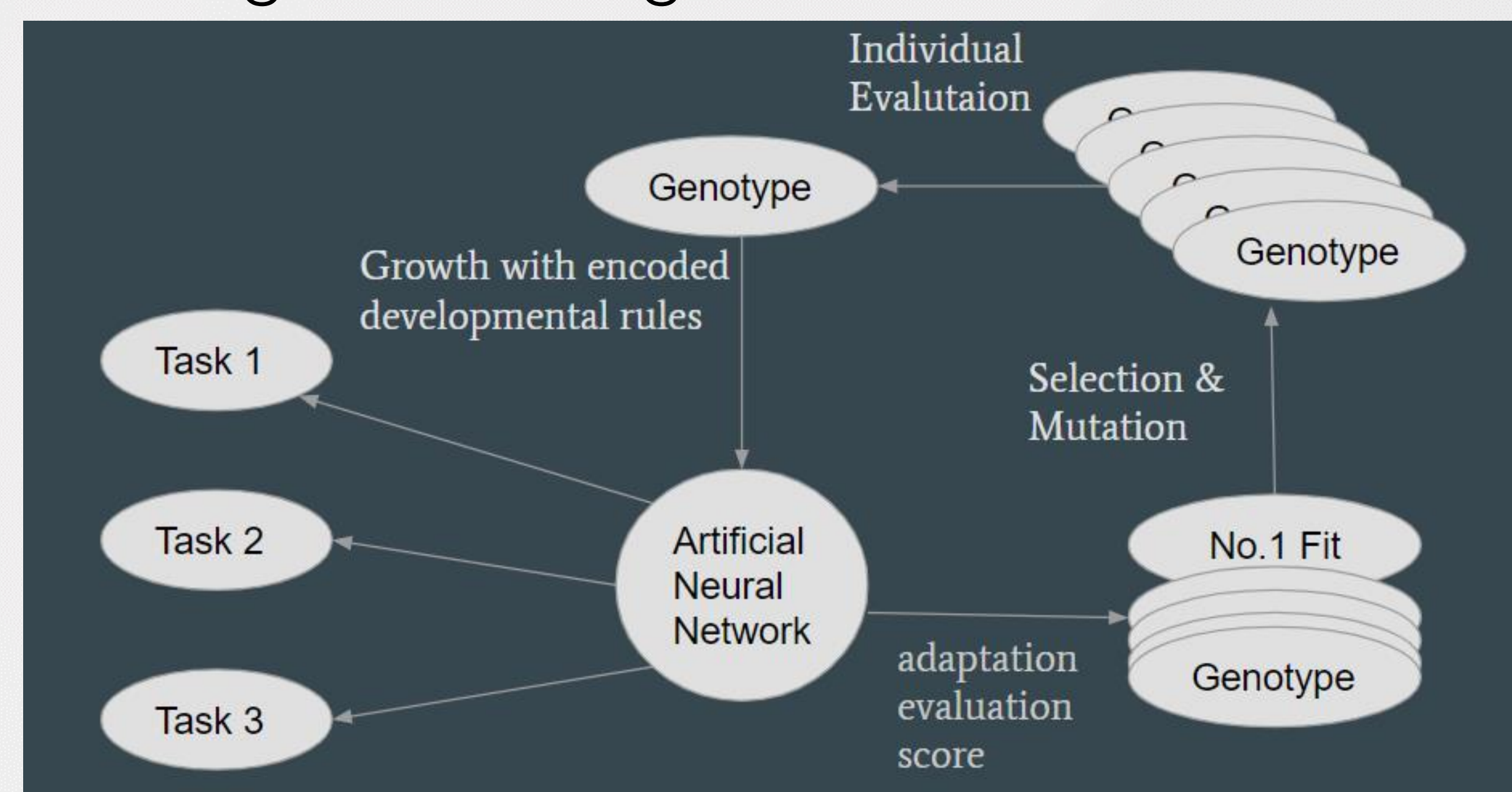
Introduction

- **Artificial Neural Network (ANN)** is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain.
- **Evolutionary Algorithm:**



Motivation

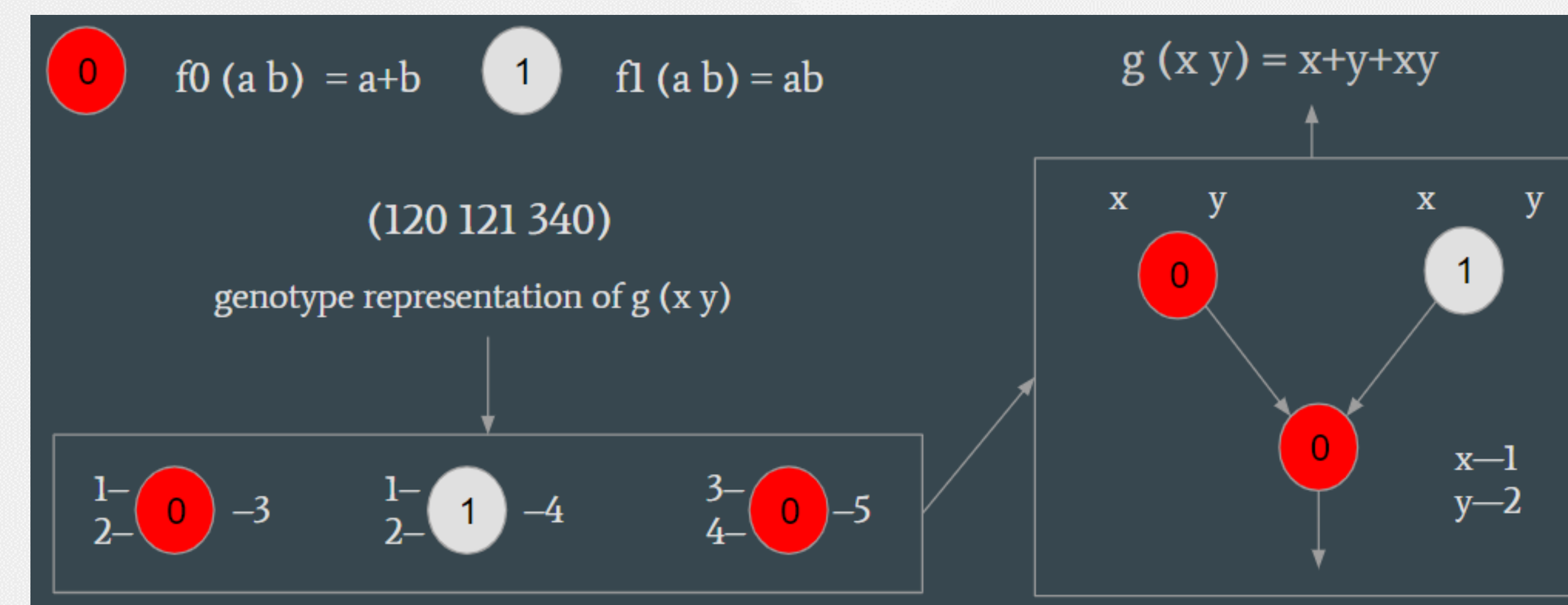
- A previous model attempted to mimic the entire evolutionary development in the process of building and training ANNs.



- It can evolve an ANN that solves multiple problems in a few generations
- The accuracy and learning efficiency could be improved by an adaptive learning behavior

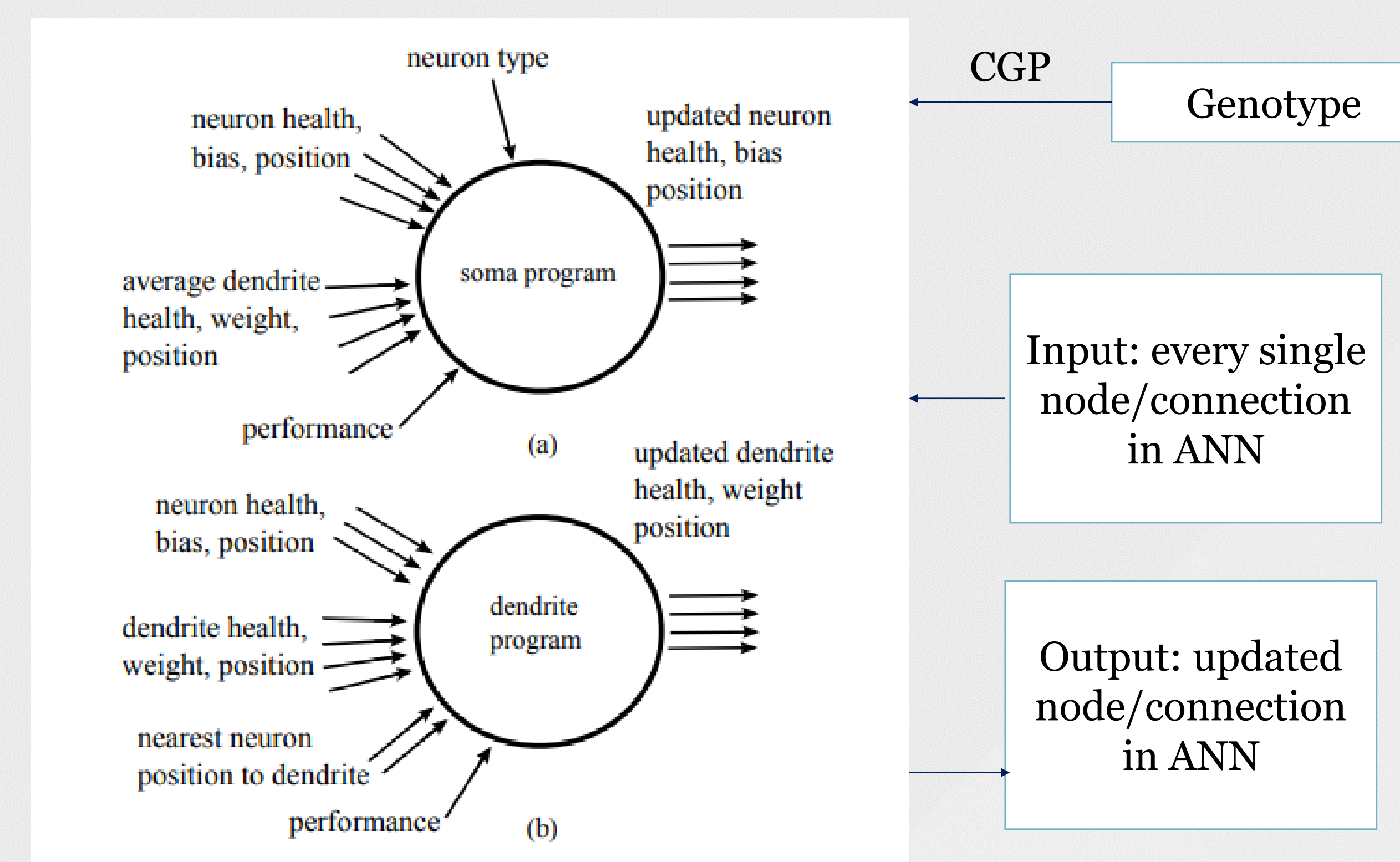
Methodology

• Cartesian Genetic Programming (CGP):



- A technique used to translate genotype strings into working programs that make an ANN grow
- Allows the program to evolve, which simulates the evolvable developmental rules affecting the growth of a natural organism

• The development of an ANN:

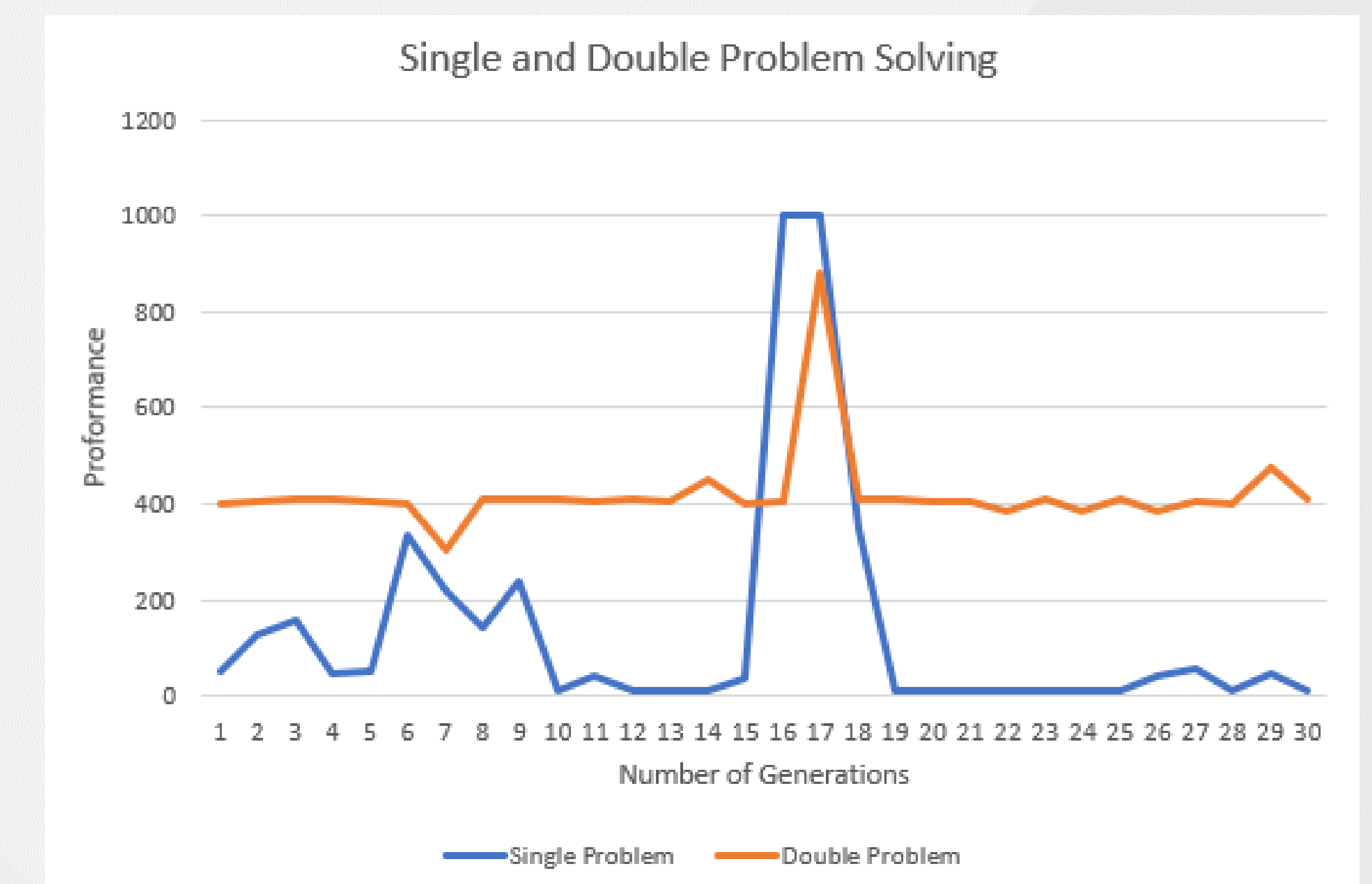


- A small starting network undergoes the above process multiple times to form an ANN based on the genotype
- The resulting ANN will have the exact number of inputs and outputs needed to solve the tasks

• Adaptive Activity Dependence

- Activity Dependence (AD) refers to adjusting NN parameters based on neural activities (i.e. "Learning" for biological organisms)
- Previous works showed AD is effective. This work aims to test an evolvable AD behavior

Experiments



• Single problem solving

- The model found the optimal solution in a few generations
- Best score decreases after finding the optimal ANN, similar to overfitting

• Double problem solving

- The combined performance score for the 2 problems has a similar shape in the graph
- Evolutionary algorithm makes the resulting ANN adapt to more than one problems quickly

Future Work

- Test the model with more and different combination of problems
- Compare its performance with other similar ANN models for evaluation
- Optimized data and execution flow for large-scale model and improved training speed
- Customized ANN library ensuring stability