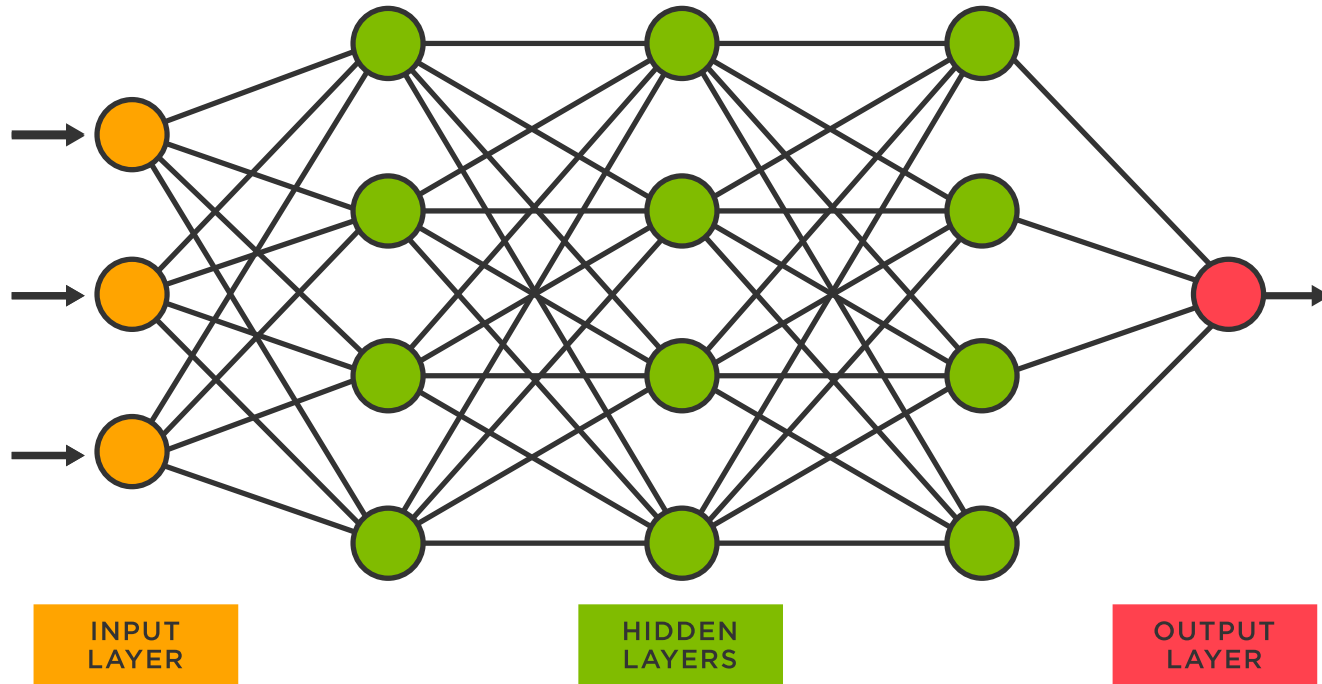


Understanding Neural Network Architecture Using Evolutionary Algorithm Search

Ammar Mukadam

Neural Networks



Source: TIBCO

Weights and Biases

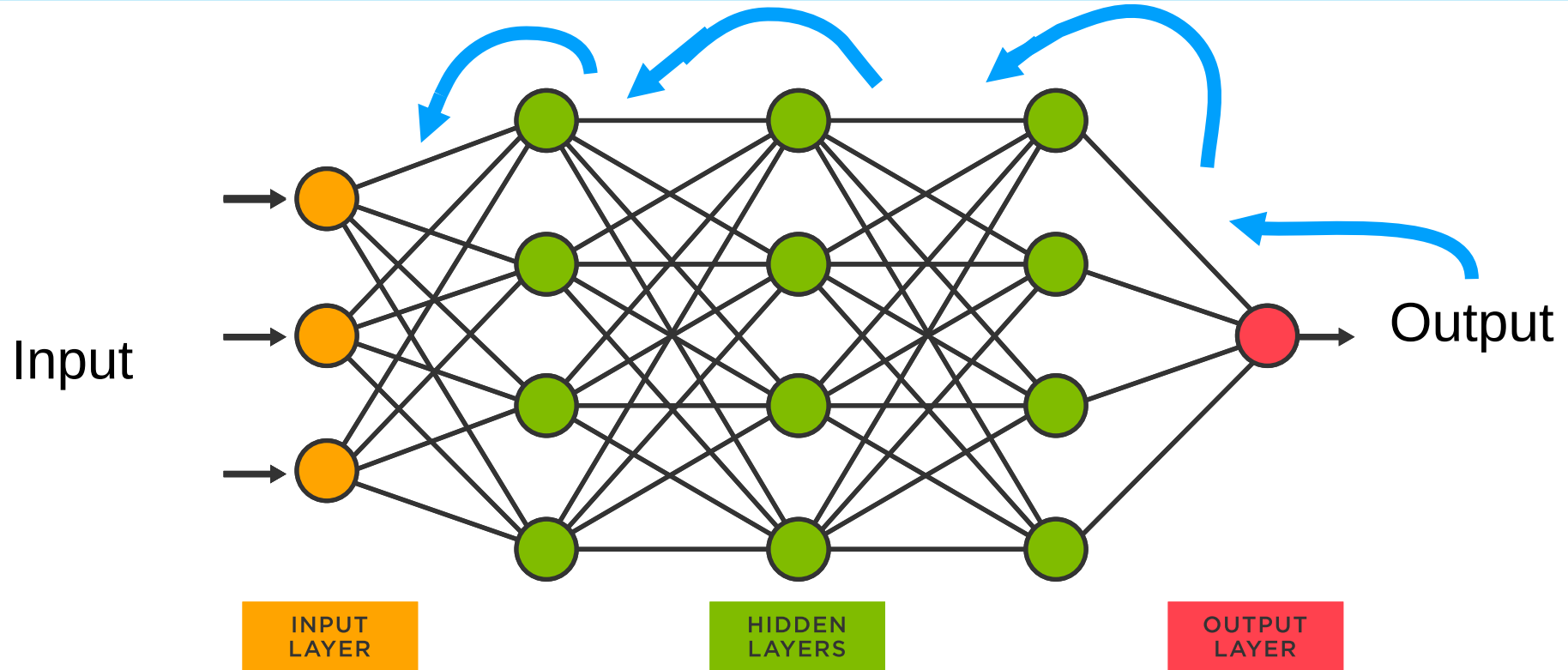
Focus on the connections between neurons:

- **Weights:** value of each neural connection to the final output
- **Bias:** threshold for a neuron to activate based on the input it receives.

Are we actually learning?

- Loss function: understanding the network's progress towards consistently outputting the expected result.
- How accurate is our neural network?

Back-propagation



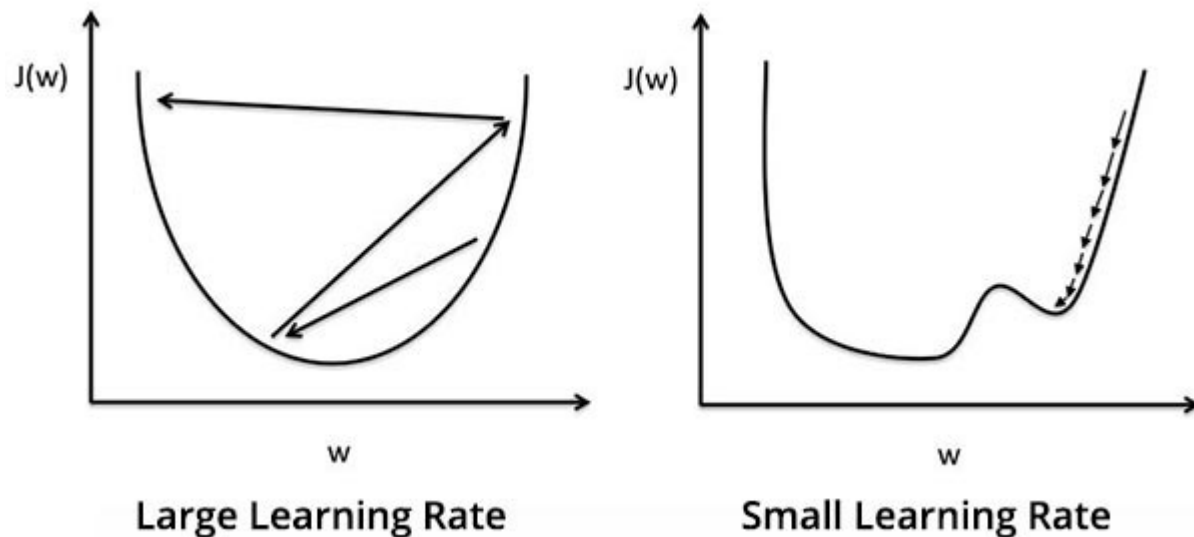
Source: TIBCO

Investigating The Hidden Layers

- How many layers are in the hidden layers?
- How many neurons are in these layers?
- Plus the many other hyperparameters

Network Hyperparameters

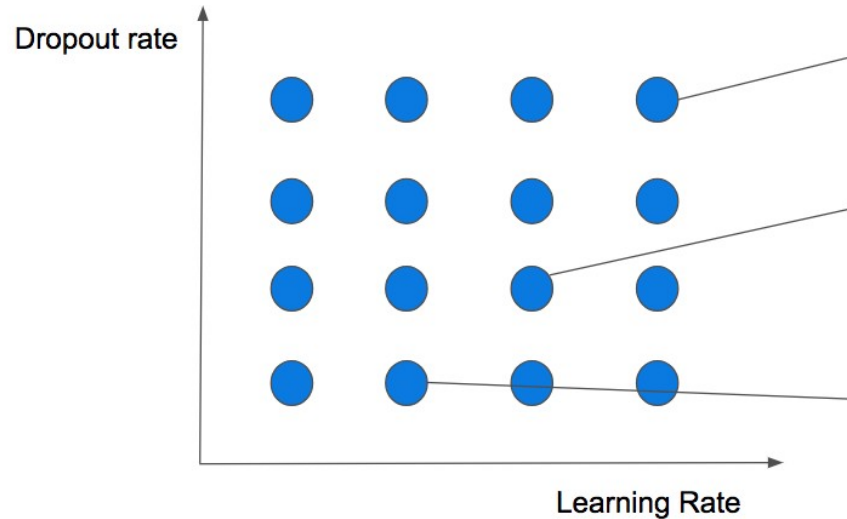
- Number of layers & neurons per layer
- Activation function
- Learning rate
- Dropout layers
- Cost function
- TensorFlow



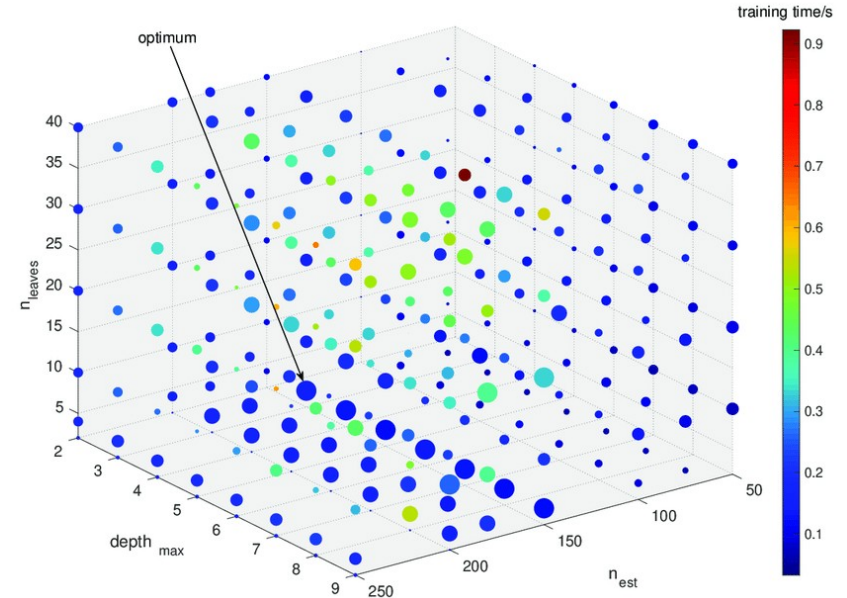
Source: SaugatBhattara

How do we find the optimal combination of hyperparameters?

- Several methods, for example **Grid Search**



Source: FloydHub

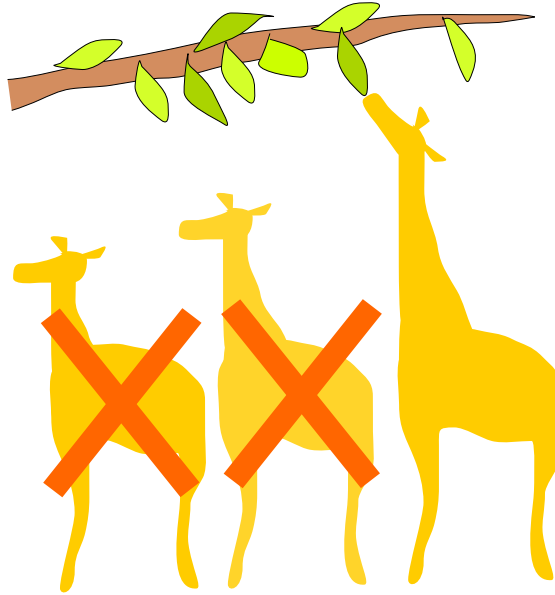


Source: ResearchGate

Evolutionary Algorithm Search

Evolution

- **Survival of the fittest**



Source:
Wikimedia
Commons

Choosing the best individuals

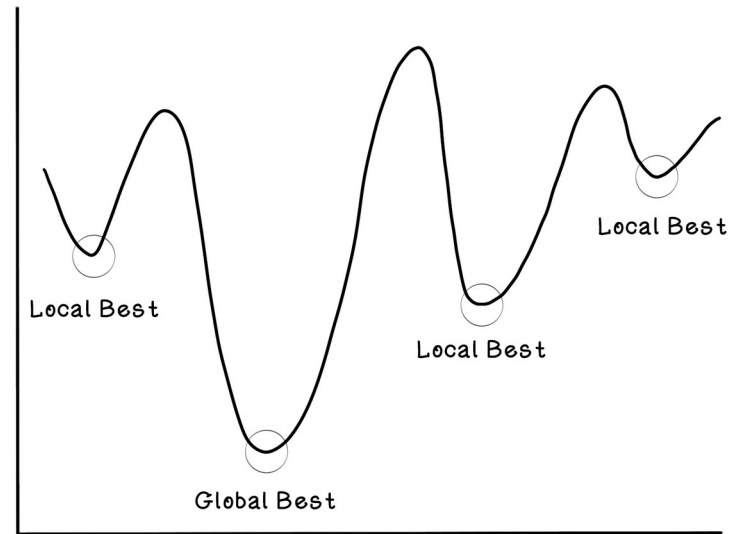
- Fitness function:
 - Accuracy
 - F1 Score
 - Minimizing Loss
 - Completion Time

How the search works

- All of these hyperparameter combinations = individuals
- Each individual made up of a chromosome that represents specific hyperparameters
- These individuals make up the population

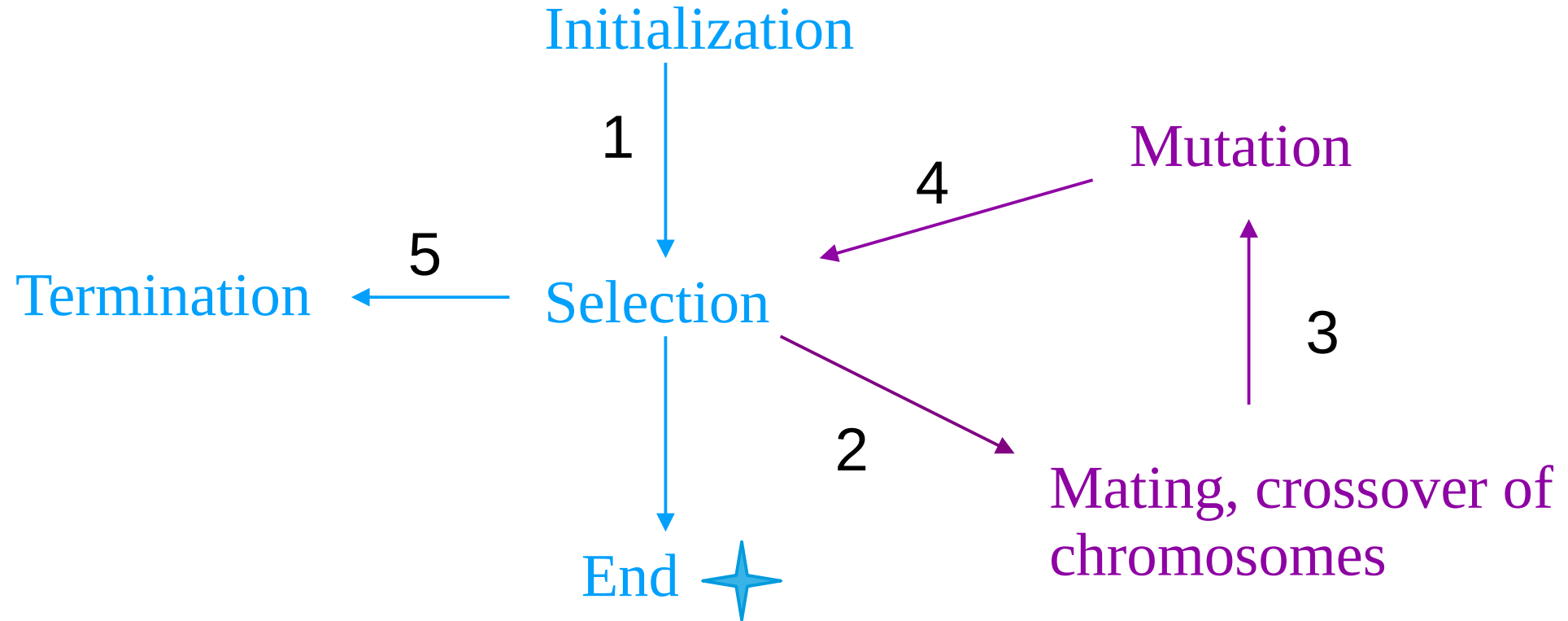
Following Evolution

- Individuals are mated, chromosomes combined.
- Variable chance of mutation to increase diversity



Source: Manning.com

The process as a whole



Wait a minute...

- How many individuals do we start with?
- How many generations do we run?
- Plus the many other hyperparameters

We've been here before...



Genetic Search Hyperparameters

- # of starting indiv. & # of generations
 - Mutation rate
 - Death %
 - # of parents mating
-
- Current model is a proof of concept
 - Our chosen search hyperparameters have proven to be best for small datasets

For larger datasets with more hyperparameters:

↑ # of generations

↑ # of starting indiv.

↓ Death rate%

Future Plans

- Bayesian optimization: method that learns from its guesses to find the optimal hyperparameters for the search.

Overview

Hyperparamters of genetic search



Hyperparameters of neural network



Neural network best set up to learn

Thank you!