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In [1]: import os
import neat
import Visualize

In [2]: # The XOR inputs and expected corresponding outputs for fitness evaluation
local_dir = os.path.dirname(__file__)
out_dir = os.path.join(local_dir, 'out')
xor_inputs = [(0.0, 0.0), (0.0, 1.0), (1.0, 0.0), (1.0, 1.0)]
xor_outputs = [(0.0,), (1.0,), (1.0,), (0.0,)]

In [3]: def eval_fitness(net):
"""
Evaluates fitness of the genome that was used to generate
provided net
Arguments:
net: The feed-forward neural network generated from genome
Returns:
The fitness score - the higher score the means
the better fit organism. Maximal score: 16.0
"""
error_sum = 0.0

for xi, xo in zip(xor_inputs, xor_outputs):
    output = net.activate(xi)
    error_sum += abs(xo[0] - output[0])

# calculate amplified fitness
fitness = (4 - error_sum) ** 2
return fitness

In [4]: def eval_genomes(genomes, config):
"""
The function to evaluate the fitness of each genome in
the genomes list.
The provided configuration is used to create feed-forward
neural network from each genome and after that created
the neural network evaluated in its ability to solve
XOR problem. As a result of this function execution, the
fitness score of each genome updated to the newly
evaluated one.
Arguments:
genomes: The list of genomes from population in the
current generation
config: The configuration settings with algorithm
hyper-parameters
"""
for genome_id, genome in genomes:
    genome.fitness = 4.0
    net = neat.nn.FeedForwardNetwork.create(genome, config)
    genome.fitness = eval_fitness(net)

In [5]: def run_experiment(config_file):
"""
The function to run XOR experiment against hyper-parameters
defined in the provided configuration file.
The winner genome will be rendered as a graph as well as the
important statistics of neuroevolution process execution.
Arguments:
config_file: the path to the file with experiment
configuration
"""
# Load configuration.
config = neat.Config(neat.DefaultGenome, neat.DefaultReproduction,
                     neat.DefaultSpeciesSet, neat.DefaultStagnation,
                     config_file)

# Create the population, which is the top-level object for a NEAT run.
p = neat.Population(config)

# Add a stdout reporter to show progress in the terminal.
p.add_reporter(neat.StdOutReporter(True))
stats = neat.StatisticsReporter()
p.add_reporter(stats)
p.add_reporter(neat.Checkpointer(5, filename_prefix='out/neat-checkpoint-'))

# Run for up to 300 generations.
best_genome = p.run(eval_genomes, 300)

# Display the best genome among generations.
print('\nBest genome:\n{}\n'.format(best_genome))

# Show output of the most fit genome against training data.
print('Input:\n')
net = neat.nn.FeedForwardNetwork.create(best_genome, config)
for xi, xo in zip(xor_inputs, xor_outputs):
    output = net.activate(xi)
    print("Input {}, expected output {}, got {}".format(xi, xo, output))

# Check if the best genome is an adequate XOR solver
best_genome_fitness = eval_fitness(net)
if best_genome_fitness > config.fitness_threshold:
    print("\n\nSUCCESS: The XOR problem solver found!!!")
else:
    print("\n\nFAILURE: Failed to find XOR problem solver!!!")

# Visualize the experiment results
node_names = {-1:'A', -2:'B', 0:'A XOR B'}
Visualize.draw_net(config, best_genome, True, node_names=node_names, directory=out_dir)
Visualize.plot_stats(stats, ylog=False, view=True, filename=os.path.join(out_dir, 'avg_fitness.svg'))
Visualize.plot_species(stats, view=True, filename=os.path.join(out_dir, 'speciation.svg'))

In [6]: import shutil
def clean_output():
    if os.path.isdir(out_dir):
        # remove files from previous run
        shutil.rmtree(out_dir)

    # create the output directory
    os.makedirs(out_dir, exist_ok=True)

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In [8]: config_path = os.path.join(local_dir, 'xor_config.ini')
clean_output()
run_experiment(config_path)

***** Running generation 0 *****

Population's average fitness: 4.10673 stdev: 1.19883
Best fitness: 8.55751 - size: (1, 2) - species 1 - id 149
Average adjusted fitness: 0.381
Mean genetic distance 1.367, standard deviation 0.421
Population of 150 members in 1 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    0    150     8.6    0.381    0
Total extinctions: 0
Generation time: 0.019 sec

***** Running generation 1 *****

Population's average fitness: 4.45797 stdev: 1.15018
Best fitness: 8.67865 - size: (1, 2) - species 1 - id 152
Average adjusted fitness: 0.302
Mean genetic distance 1.378, standard deviation 0.470
Population of 150 members in 1 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    1    150     8.7    0.302    0
Total extinctions: 0
Generation time: 0.019 sec (0.019 average)

***** Running generation 2 *****

Population's average fitness: 4.51416 stdev: 1.42873
Best fitness: 8.87987 - size: (1, 2) - species 1 - id 444
Average adjusted fitness: 0.406
Mean genetic distance 1.653, standard deviation 0.479
Population of 150 members in 1 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    2    150     8.9    0.406    0
Total extinctions: 0
Generation time: 0.021 sec (0.020 average)

***** Running generation 3 *****

Population's average fitness: 4.61278 stdev: 1.48721
Best fitness: 8.97378 - size: (1, 2) - species 1 - id 562
Average adjusted fitness: 0.393
Mean genetic distance 1.694, standard deviation 0.504
Population of 150 members in 1 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    3    150     9.0    0.393    0
Total extinctions: 0
Generation time: 0.023 sec (0.020 average)

***** Running generation 4 *****

Population's average fitness: 5.04305 stdev: 1.76048
Best fitness: 8.98759 - size: (2, 4) - species 1 - id 729
Average adjusted fitness: 0.361
Mean genetic distance 1.904, standard deviation 0.709
Population of 150 members in 2 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    4    143     9.0    0.361    0
   2    0    7      --      --      0
Total extinctions: 0
Generation time: 0.026 sec (0.022 average)
Saving checkpoint to out/neat-checkpoint-4

***** Running generation 5 *****

Population's average fitness: 5.13665 stdev: 1.90674
Best fitness: 8.98899 - size: (2, 5) - species 1 - id 797
Average adjusted fitness: 0.483
Mean genetic distance 2.042, standard deviation 0.691
Population of 150 members in 2 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    5    114     9.0    0.513    0
   2    1    36      8.9    0.454    0
Total extinctions: 0
Generation time: 0.024 sec (0.022 average)

***** Running generation 6 *****

Population's average fitness: 4.87979 stdev: 1.87915
Best fitness: 8.99776 - size: (2, 4) - species 1 - id 950
Average adjusted fitness: 0.459
Mean genetic distance 1.825, standard deviation 0.609
Population of 150 members in 2 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    6    104     9.0    0.498    0
   2    2    46      9.0    0.420    0
Total extinctions: 0
Generation time: 0.026 sec (0.023 average)

***** Running generation 7 *****

Population's average fitness: 5.09817 stdev: 1.92020
Best fitness: 8.99938 - size: (2, 5) - species 1 - id 1148
Average adjusted fitness: 0.443
Mean genetic distance 1.858, standard deviation 0.606
Population of 150 members in 2 species:
   ID  age  size  fitness  adj fit  stag
   ===  ==  ===  =====  =====  ===
   1    7    112     9.0    0.496    0
   2    3    38      9.0    0.391    1
Total extinctions: 0
Generation time: 0.029 sec (0.023 average)

***** Running generation 8 *****
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Population's average fitness: 5.56895 stdev: 2.22633  
 Best fitness: 8.99968 - size: (2, 5) - species 1 - id 1246  
 Average adjusted fitness: 0.515  
 Mean genetic distance 1.878, standard deviation 0.672  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 8 106 9.0 0.574 0  
 2 4 44 9.0 0.456 0  
 Total extinctions: 0  
 Generation time: 0.028 sec (0.024 average)  
 \*\*\*\*\* Running generation 9 \*\*\*\*\*  
  
 Population's average fitness: 5.33626 stdev: 2.06744  
 Best fitness: 8.99969 - size: (2, 5) - species 1 - id 1472  
 Average adjusted fitness: 0.448  
 Mean genetic distance 1.842, standard deviation 0.691  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 9 93 9.0 0.501 0  
 2 5 57 9.0 0.395 0  
 Total extinctions: 0  
 Generation time: 0.032 sec (0.025 average)  
 Saving checkpoint to out/neat-checkpoint-9  
  
 \*\*\*\*\* Running generation 10 \*\*\*\*\*  
  
 Population's average fitness: 5.32692 stdev: 2.11835  
 Best fitness: 8.99993 - size: (2, 5) - species 1 - id 1585  
 Average adjusted fitness: 0.498  
 Mean genetic distance 1.912, standard deviation 0.665  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 10 97 9.0 0.557 0  
 2 6 53 9.0 0.439 1  
 Total extinctions: 0  
 Generation time: 0.031 sec (0.026 average)  
  
 \*\*\*\*\* Running generation 11 \*\*\*\*\*  
  
 Population's average fitness: 5.22174 stdev: 2.11655  
 Best fitness: 8.99993 - size: (2, 5) - species 1 - id 1585  
 Average adjusted fitness: 0.507  
 Mean genetic distance 1.873, standard deviation 0.663  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 11 97 9.0 0.549 1  
 2 7 53 9.0 0.466 2  
 Total extinctions: 0  
 Generation time: 0.029 sec (0.027 average)  
  
 \*\*\*\*\* Running generation 12 \*\*\*\*\*  
  
 Population's average fitness: 5.87467 stdev: 2.26798  
 Best fitness: 8.99999 - size: (2, 5) - species 1 - id 1864  
 Average adjusted fitness: 0.534  
 Mean genetic distance 1.903, standard deviation 0.658  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 12 98 9.0 0.634 0  
 2 8 52 9.0 0.435 0  
 Total extinctions: 0  
 Generation time: 0.031 sec (0.028 average)  
  
 \*\*\*\*\* Running generation 13 \*\*\*\*\*  
  
 Population's average fitness: 5.97452 stdev: 2.37296  
 Best fitness: 8.99999 - size: (2, 5) - species 1 - id 1864  
 Average adjusted fitness: 0.594  
 Mean genetic distance 1.924, standard deviation 0.606  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 13 96 9.0 0.684 1  
 2 9 54 9.0 0.504 1  
 Total extinctions: 0  
 Generation time: 0.030 sec (0.029 average)  
  
 \*\*\*\*\* Running generation 14 \*\*\*\*\*  
  
 Population's average fitness: 5.87268 stdev: 2.27214  
 Best fitness: 8.99999 - size: (2, 5) - species 1 - id 1864  
 Average adjusted fitness: 0.471  
 Mean genetic distance 1.990, standard deviation 0.547  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == === ====== ====== ====  
 1 14 101 9.0 0.549 2  
 2 10 49 9.0 0.393 0  
 Total extinctions: 0  
 Generation time: 0.032 sec (0.029 average)  
 Saving checkpoint to out/neat-checkpoint-14  
  
 \*\*\*\*\* Running generation 15 \*\*\*\*\*  
  
 Population's average fitness: 6.08998 stdev: 2.36093  
 Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312  
 Average adjusted fitness: 0.590  
 Mean genetic distance 1.985, standard deviation 0.602  
 Population of 150 members in 2 species:  
 ID age size fitness adj fit stag  
 === == == ====== ====== ====  
 1 15 100 9.1 0.687 0  
 2 11 50 9.0 0.494 0  
 Total extinctions: 0  
 Generation time: 0.036 sec (0.030 average)  
  
 \*\*\*\*\* Running generation 16 \*\*\*\*\*  
  
 Population's average fitness: 5.95705 stdev: 2.30234  
 Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2212

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***** Average adjusted fitness: 0.377
Mean genetic distance 1.981, standard deviation 0.606
Population of 150 members in 2 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   16   101   9.1   0.422   1
    2   12   49    9.0   0.332   0
Total extinctions: 0
Generation time: 0.043 sec (0.032 average)

***** Running generation 17 *****

Population's average fitness: 6.08486 stdev: 2.34901
Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312
Average adjusted fitness: 0.527
Mean genetic distance 2.036, standard deviation 0.594
Population of 150 members in 2 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   17   103   9.1   0.572   2
    2   13   47    9.0   0.482   0
Total extinctions: 0
Generation time: 0.036 sec (0.033 average)

***** Running generation 18 *****

Population's average fitness: 5.90709 stdev: 2.39576
Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312
Average adjusted fitness: 0.598
Mean genetic distance 1.995, standard deviation 0.625
Population of 150 members in 2 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   18   96    9.1   0.608   3
    2   14   54    9.0   0.587   0
Total extinctions: 0
Generation time: 0.033 sec (0.033 average)

***** Running generation 19 *****

Population's average fitness: 6.11334 stdev: 2.50559
Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312
Average adjusted fitness: 0.621
Mean genetic distance 1.944, standard deviation 0.660
Population of 150 members in 2 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   19   98    9.1   0.651   4
    2   15   52    9.0   0.591   0
Total extinctions: 0
Generation time: 0.031 sec (0.033 average)
Saving checkpoint to out/neat-checkpoint-19

***** Running generation 20 *****

Population's average fitness: 6.14336 stdev: 2.47853
Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312
Average adjusted fitness: 0.628
Mean genetic distance 2.000, standard deviation 0.742
Population of 150 members in 3 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   20   92    9.1   0.663   5
    2   16   57    9.0   0.592   1
    3   0    1     --    --     0
Total extinctions: 0
Generation time: 0.029 sec (0.033 average)

***** Running generation 21 *****

Population's average fitness: 6.09708 stdev: 2.42435
Best fitness: 9.05482 - size: (3, 6) - species 1 - id 2312
Average adjusted fitness: 0.512
Mean genetic distance 2.237, standard deviation 0.885
Population of 150 members in 3 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   21   83    9.1   0.667   6
    2   17   48    9.0   0.532   2
    3   1    19    4.0   0.339   0
Total extinctions: 0
Generation time: 0.067 sec (0.037 average)

***** Running generation 22 *****

Population's average fitness: 6.03612 stdev: 2.44401
Best fitness: 10.04927 - size: (3, 6) - species 1 - id 3341
Average adjusted fitness: 0.493
Mean genetic distance 2.448, standard deviation 0.882
Population of 149 members in 4 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   22   90    10.0   0.651   0
    2   18   29    9.0   0.470   0
    3   2    22    9.0   0.360   0
    4   0    8     --    --     0
Total extinctions: 0
Generation time: 0.041 sec (0.038 average)

***** Running generation 23 *****

Population's average fitness: 6.04624 stdev: 2.41108
Best fitness: 10.04927 - size: (3, 6) - species 1 - id 3341
Average adjusted fitness: 0.254
Mean genetic distance 2.554, standard deviation 0.850
Population of 150 members in 4 species:
    ID age size fitness adj fit stag
    ===  ==  ===  =====  =====  ===
    1   23   79    10.0   0.498   1
    2   19   21    9.0   0.235   1
    3   3    15    5.4   0.059   1
    4   1    35    9.2   0.224   0
Total extinctions: 0
Generation time: 0.038 sec (0.039 average)

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\*\*\*\*\* Running generation 24 \*\*\*\*\*

Population's average fitness: 6.14445 stdev: 2.48027  
Best fitness: 11.20055 - size: (3, 7) - species 4 - id 3593  
Average adjusted fitness: 0.456  
Mean genetic distance 2.458, standard deviation 0.714  
Population of 150 members in 4 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 24 55 9.0 0.571 2  
2 20 28 9.0 0.477 0  
3 4 30 7.5 0.334 2  
4 2 37 11.2 0.440 0  
Total extinctions: 0  
Generation time: 0.041 sec (0.039 average)  
Saving checkpoint to out/neat-checkpoint-24

\*\*\*\*\* Running generation 25 \*\*\*\*\*

Population's average fitness: 5.78140 stdev: 2.42650  
Best fitness: 11.20055 - size: (3, 7) - species 4 - id 3593  
Average adjusted fitness: 0.442  
Mean genetic distance 2.446, standard deviation 0.718  
Population of 150 members in 4 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 25 52 9.0 0.594 3  
2 21 25 9.0 0.381 0  
3 5 28 8.9 0.354 3  
4 3 45 11.2 0.439 1  
Total extinctions: 0  
Generation time: 0.039 sec (0.040 average)

\*\*\*\*\* Running generation 26 \*\*\*\*\*

Population's average fitness: 5.82454 stdev: 2.35036  
Best fitness: 11.20055 - size: (3, 7) - species 4 - id 3593  
Average adjusted fitness: 0.377  
Mean genetic distance 2.383, standard deviation 0.796  
Population of 150 members in 4 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 26 46 9.0 0.468 4  
2 22 25 9.0 0.344 1  
3 6 29 8.9 0.323 4  
4 4 50 11.2 0.374 2  
Total extinctions: 0  
Generation time: 0.045 sec (0.040 average)

\*\*\*\*\* Running generation 27 \*\*\*\*\*

Population's average fitness: 5.97119 stdev: 2.32955  
Best fitness: 11.20055 - size: (3, 7) - species 4 - id 3593  
Average adjusted fitness: 0.399  
Mean genetic distance 2.471, standard deviation 0.825  
Population of 149 members in 4 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 27 34 9.0 0.476 5  
2 23 22 9.0 0.286 2  
3 7 33 8.9 0.419 5  
4 5 60 11.2 0.415 3  
Total extinctions: 0  
Generation time: 0.053 sec (0.042 average)

\*\*\*\*\* Running generation 28 \*\*\*\*\*

Population's average fitness: 5.90832 stdev: 2.48350  
Best fitness: 11.90293 - size: (3, 6) - species 4 - id 4215  
Average adjusted fitness: 0.453  
Mean genetic distance 2.559, standard deviation 0.849  
Population of 149 members in 5 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 28 26 9.0 0.465 6  
2 24 30 9.0 0.483 3  
3 8 37 9.0 0.433 6  
4 6 55 11.9 0.433 0  
5 0 1 -- -- 0 0  
Total extinctions: 0  
Generation time: 0.043 sec (0.043 average)

\*\*\*\*\* Running generation 29 \*\*\*\*\*

Population's average fitness: 5.73840 stdev: 2.46523  
Best fitness: 12.53365 - size: (3, 6) - species 4 - id 4340  
Average adjusted fitness: 0.349  
Mean genetic distance 2.608, standard deviation 0.866  
Population of 150 members in 5 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 29 27 9.0 0.397 7  
2 25 30 9.0 0.366 0  
3 9 32 9.0 0.411 7  
4 7 48 12.5 0.354 0  
5 1 13 4.0 0.218 0  
Total extinctions: 0  
Generation time: 0.040 sec (0.044 average)  
Saving checkpoint to out/neat-checkpoint-29

\*\*\*\*\* Running generation 30 \*\*\*\*\*

Population's average fitness: 6.06572 stdev: 2.52150  
Best fitness: 12.53365 - size: (3, 6) - species 4 - id 4340  
Average adjusted fitness: 0.421  
Mean genetic distance 2.712, standard deviation 0.782  
Population of 150 members in 5 species:  
ID age size fitness adj fit stag  
==== === ====== ====== ====== ===  
1 30 24 9.0 0.523 8  
2 26 29 9.0 0.392 1  
3 10 40 9.0 0.502 8  
4 8 41 12.5 0.428 1  
5 2 16 4.0 0.260 0  
Total extinctions: 0

Generation time: 0.042 sec (0.045 average)

\*\*\*\*\* Running generation 31 \*\*\*\*\*

Population's average fitness: 5.85543 stdev: 2.57001  
 Best fitness: 14.03815 - size: (3, 5) - species 4 - id 4616  
 Average adjusted fitness: 0.371  
 Mean genetic distance 2.659, standard deviation 0.848  
 Population of 150 members in 5 species:

ID	age	size	fitness	adj fit	stag
1	31	25	9.0	0.487	9
2	27	25	9.0	0.296	0
3	11	36	9.0	0.374	9
4	9	42	14.0	0.378	0
5	3	22	9.0	0.318	0

Total extinctions: 0  
 Generation time: 0.043 sec (0.042 average)

\*\*\*\*\* Running generation 32 \*\*\*\*\*

Population's average fitness: 6.15964 stdev: 2.53914  
 Best fitness: 14.03815 - size: (3, 5) - species 4 - id 4616  
 Average adjusted fitness: 0.248  
 Mean genetic distance 2.639, standard deviation 0.937  
 Population of 149 members in 5 species:

ID	age	size	fitness	adj fit	stag
1	32	43	9.0	0.423	10
2	28	24	9.0	0.170	1
3	12	35	9.0	0.296	10
4	10	34	14.0	0.172	1
5	4	13	9.0	0.179	0

Total extinctions: 0  
 Generation time: 0.046 sec (0.043 average)

\*\*\*\*\* Running generation 33 \*\*\*\*\*

Population's average fitness: 6.23938 stdev: 2.57383  
 Best fitness: 14.03815 - size: (3, 5) - species 4 - id 4616  
 Average adjusted fitness: 0.354  
 Mean genetic distance 2.591, standard deviation 0.893  
 Population of 150 members in 5 species:

ID	age	size	fitness	adj fit	stag
1	33	37	9.0	0.403	11
2	29	25	9.0	0.339	0
3	13	37	9.0	0.384	11
4	11	32	14.0	0.283	2
5	5	19	9.0	0.361	1

Total extinctions: 0  
 Generation time: 0.038 sec (0.043 average)

\*\*\*\*\* Running generation 34 \*\*\*\*\*

Population's average fitness: 6.58263 stdev: 2.73515  
 Best fitness: 15.46617 - size: (3, 6) - species 4 - id 5041  
 Average adjusted fitness: 0.399  
 Mean genetic distance 2.690, standard deviation 0.918  
 Population of 150 members in 5 species:

ID	age	size	fitness	adj fit	stag
1	34	39	9.0	0.444	12
2	30	23	9.0	0.358	1
3	14	36	9.0	0.412	12
4	12	31	15.5	0.325	0
5	6	21	9.0	0.454	2

Total extinctions: 0  
 Generation time: 0.041 sec (0.043 average)  
 Saving checkpoint to out/neat-checkpoint-34

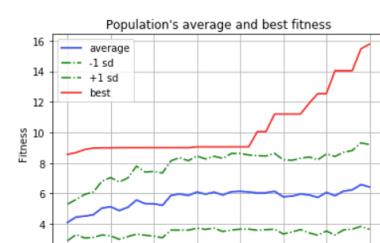
\*\*\*\*\* Running generation 35 \*\*\*\*\*

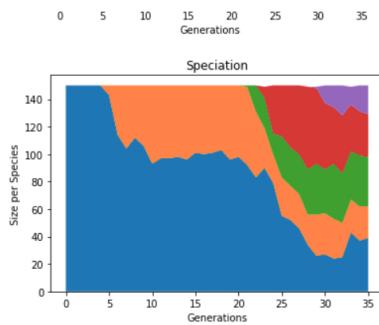
Population's average fitness: 6.42950 stdev: 2.77340  
 Best fitness: 15.78026 - size: (3, 6) - species 4 - id 5200  
 Best individual in generation 35 meets fitness threshold - complexity: (3, 6)

Best genome:  
 Key: 5200  
 Fitness: 15.78025845129345  
 Nodes:  
 0 DefaultNodeGene(key=0, bias=-3.11024277389772, response=1.0, activation=sigmoid, aggregation=sum)  
 124 DefaultNodeGene(key=124, bias=-0.341967280635316, response=1.0, activation=sigmoid, aggregation=sum)  
 407 DefaultNodeGene(key=407, bias=-0.6341273666069379, response=1.0, activation=sigmoid, aggregation=sum)  
 Connections:  
 DefaultConnectionGene(key=(-2, 0), weight=-3.1243913053456764, enabled=True)  
 DefaultConnectionGene(key=(-2, 124), weight=5.007724520211525, enabled=True)  
 DefaultConnectionGene(key=(-2, 407), weight=-0.8756324967318486, enabled=True)  
 DefaultConnectionGene(key=(-1, 0), weight=-1.7821825534682127, enabled=True)  
 DefaultConnectionGene(key=(-1, 124), weight=3.8400006711695505, enabled=True)  
 DefaultConnectionGene(key=(124, 0), weight=7.251975956588616, enabled=True)

Output:  
 input (0.0, 0.0), expected output (0.0,), got [4.5545804588429056e-05]  
 input (0.0, 1.0), expected output (1.0,), got [0.993859620269883]  
 input (1.0, 0.0), expected output (1.0,), got [0.9999924786111386]  
 input (1.0, 1.0), expected output (0.0,), got [0.02136920916609149]

SUCCESS: The XOR problem solver found!!!





In [ ]: