COMP SCI 5401 FS2017 Assignment 1c

Dalton Cole
drcgy5@mst.edu

October 9, 2017

Self-Adaptive EA Strategy Parameter

In this experiment, mutation rate was used as the self-adaptive EA strategy parameter. If the average or best fitness for the current population decreased compared to the previous population, then the mutation rate doubles, with 1 being the max possible value. If the average or best fitness increases or stays the same, then the mutation rate goes back to its original value from the configuration file. The purpose of the change in mutation rate is to increase exploration.

Self-Adaptive Performance

As can be seen from Figure 1, Figure **??**, and Figure **??**, although having self-adaptive mutation rate, increases the mean fitness value, there is no statistical difference between using the self-adaptive mutation rate strategy employed vs not using it. This is likely due to the fact that mutation resets anytime a non-decrease in fitness happens. Another appropriate strategy would be to involve the current evaluation number in the equation, such that the higher the evaluation number, the lower the mutation rate. This would increase exploration in the beginning, but decrease it as the EA narrows down on a solution.

Figures **??** and **??** show graphs for using self-adaptive mutation rate and not. Figures **??** and **??** show the corresponding pictures.

Figures

Figure 1: Self Adaptive Mutation Rate F and t tests for Input 1

Self-Adaptive Mutation Rate - Input 1 FALSE TRUE
F-Test Two-Sample for Variances

	Variable 1	*Variable 2*
Mean	-42.1292	-42.0225
Variance	2323.367	2323.782
Observations	1200	1200
df	1199	1199
F	0.999821	
P(F<=f) one-tail	0.498767	
F Critical one-tail	0.909334	

M(1) < M(2) and F > F Critical => Equal

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	-42.1292	-42.0225
Variance	2323.367	2323.782
Observations	1200	1200
Pooled Variance	2323.574	
Hypothesized Mean Difference	0	
df	2398	
t Stat	-0.0542	
P(T<=t) one-tail	0.478389	
t Critical one-tail	1.645489	
P(T<=t) two-tail	0.956778	
t Critical two-tail	1.960954	

t Stat < t Critical => No Statistical Difference

Table 1: Figure 2 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1001
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 2: Figure 4 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1002
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 2: Input 1

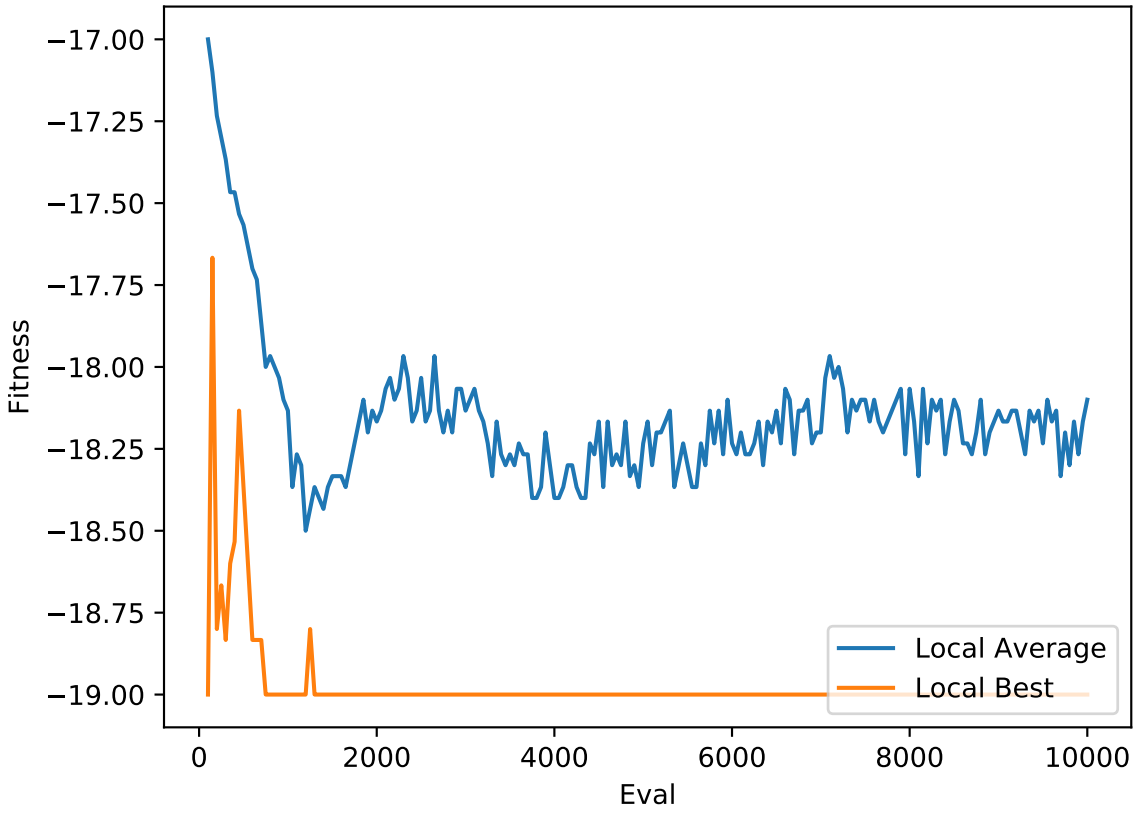

Figure 3: Figure 2 Representation

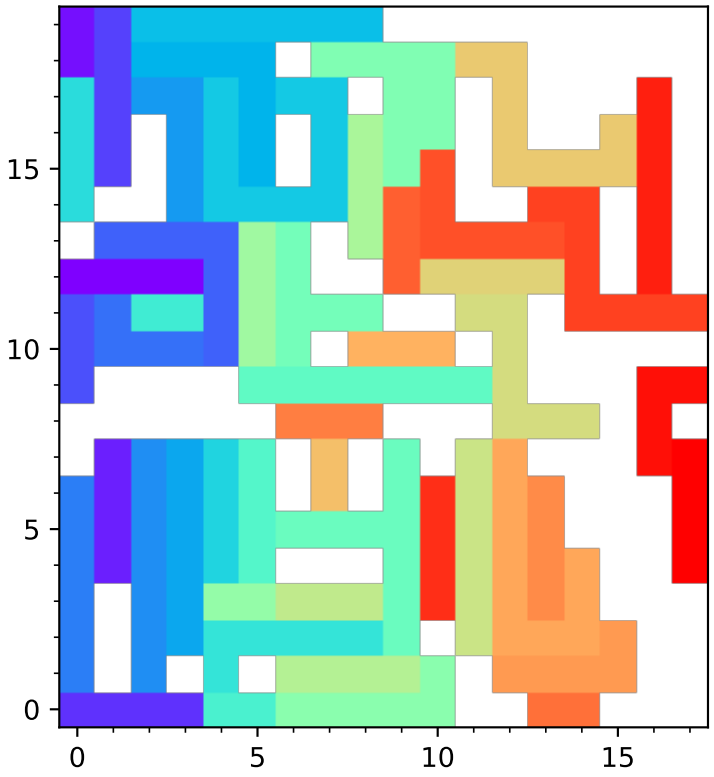

Figure 4: Input 1

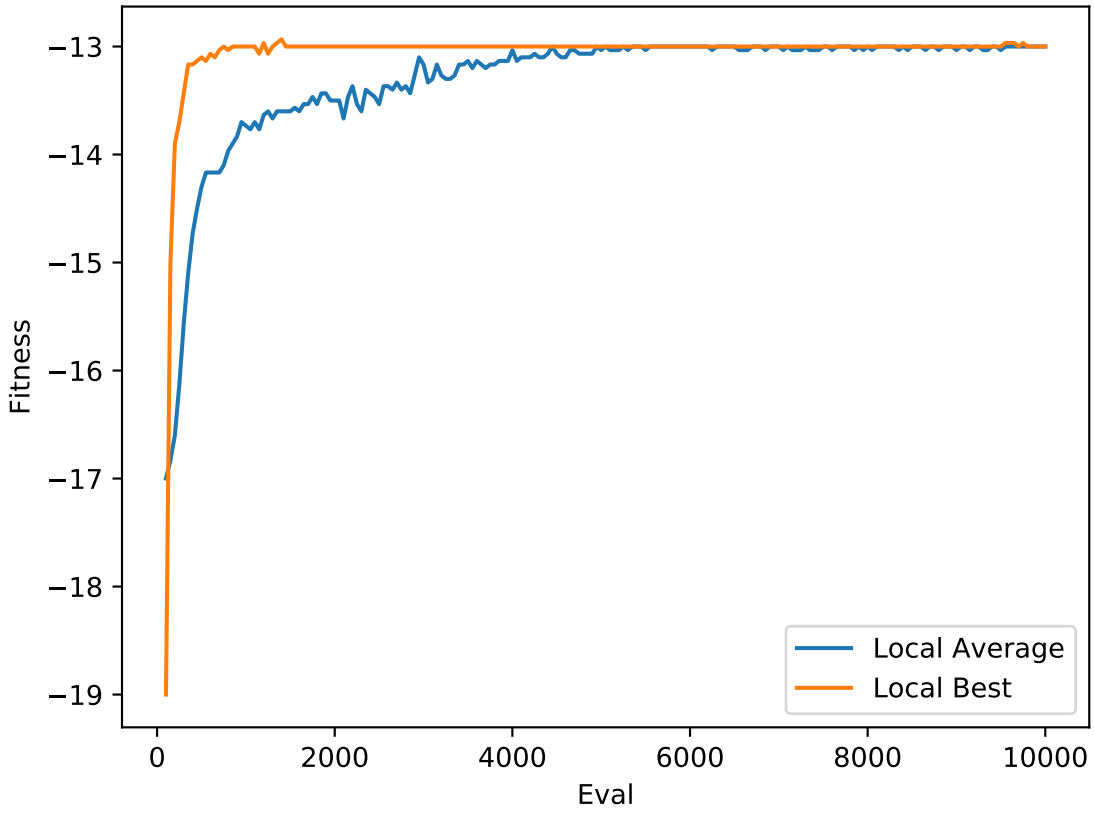

Figure 5: Figure 4 Representation

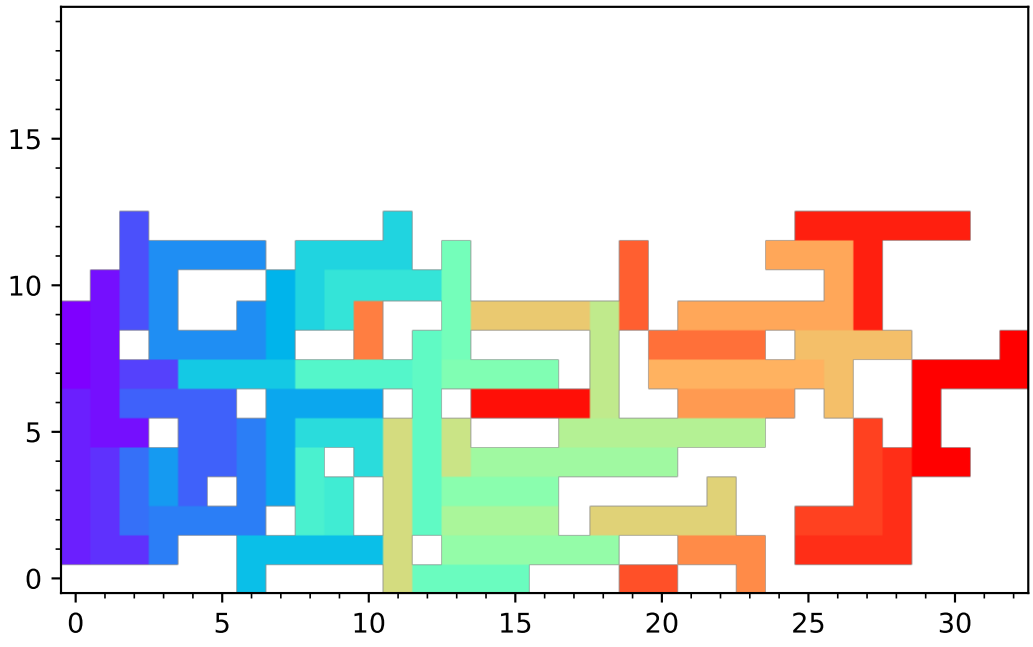

Table 3: Figure 6 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1003
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 4: Figure 8 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1004
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 6: Input 1

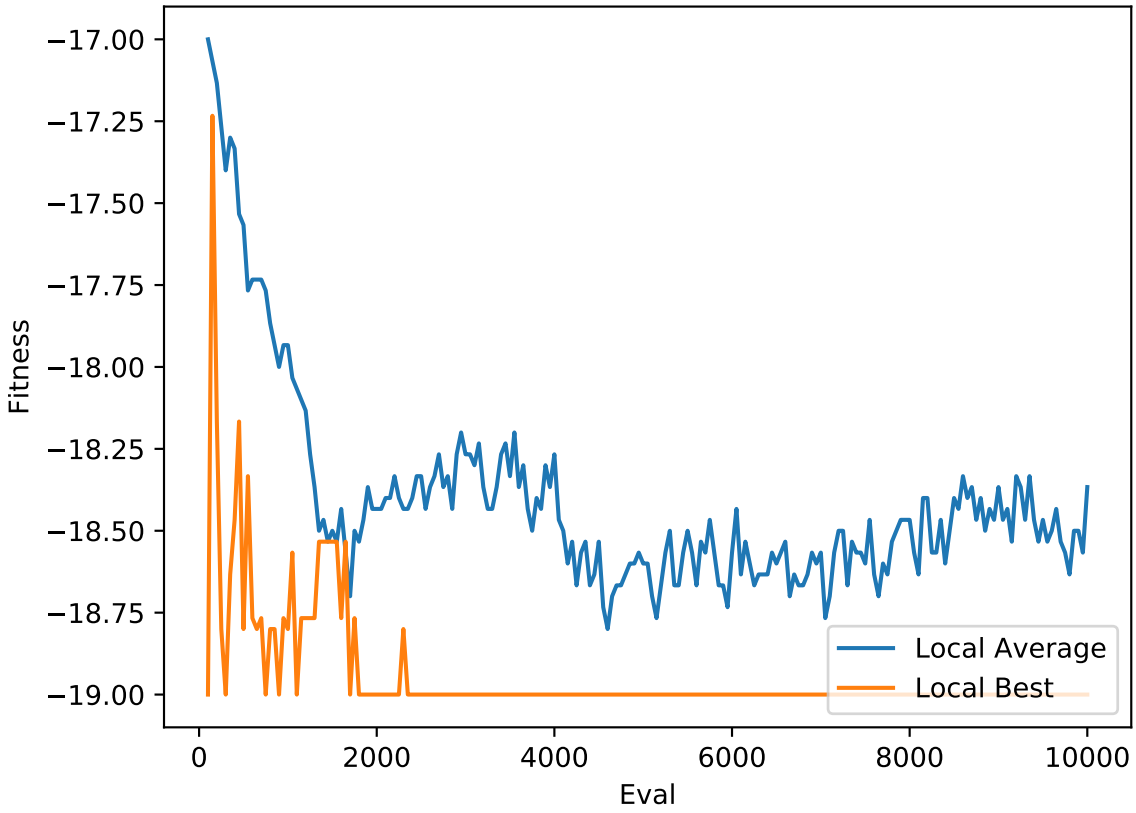

Figure 7: Figure 6 Representation

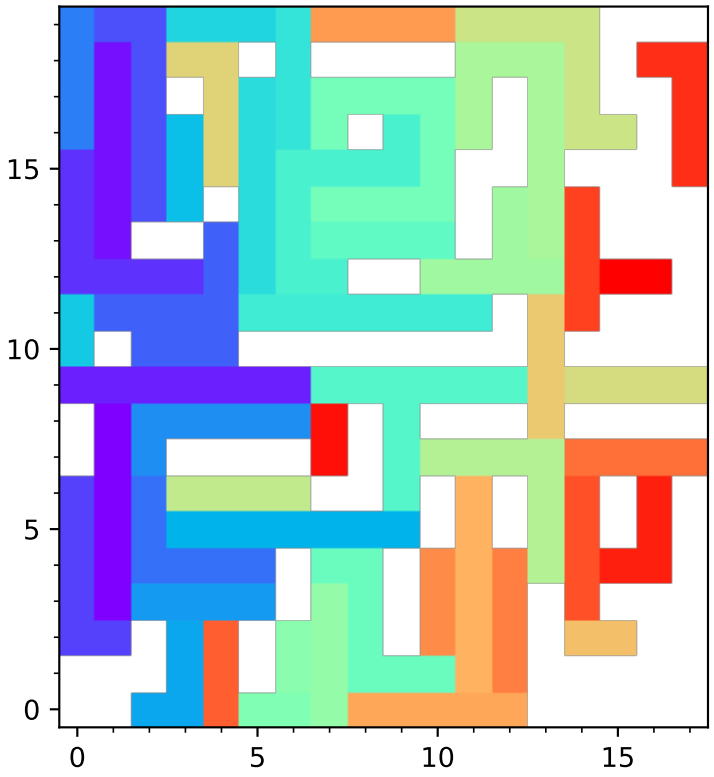

Figure 8: Input 1

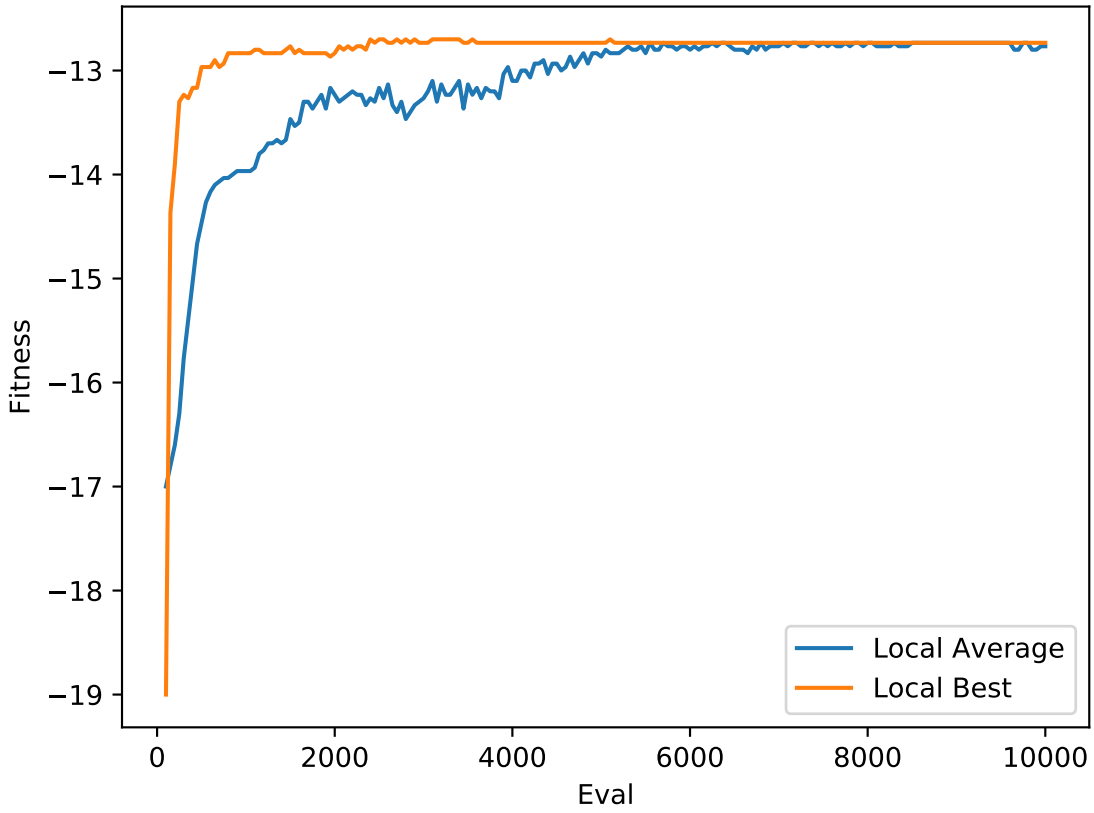

Figure 9: Figure 8 Representation

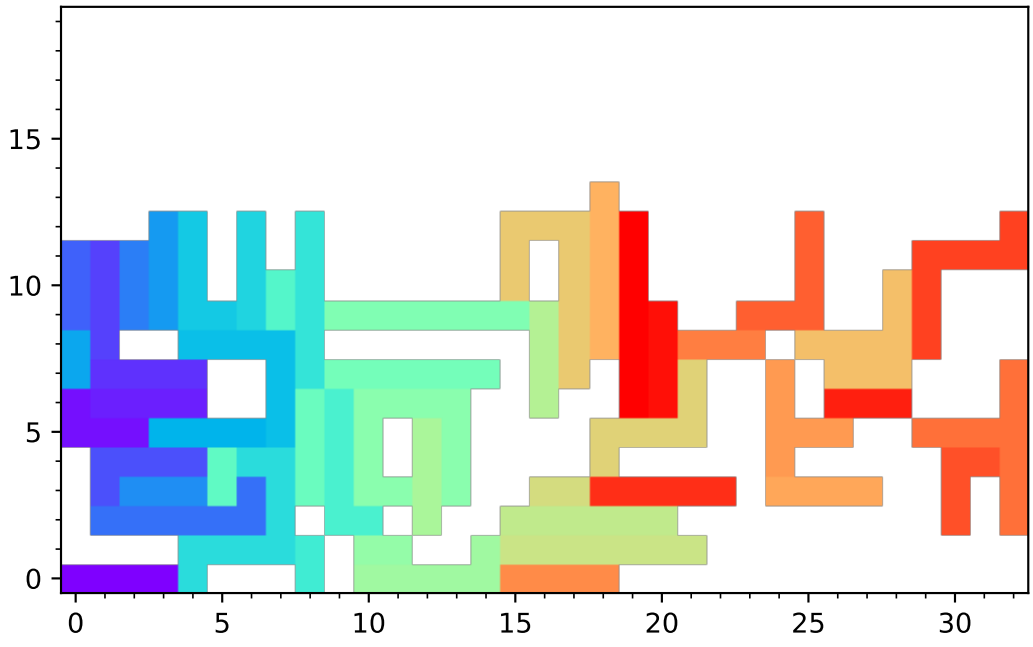

Table 5: Figure 10 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1005
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 6: Figure 12 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1006
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 10: Input 1

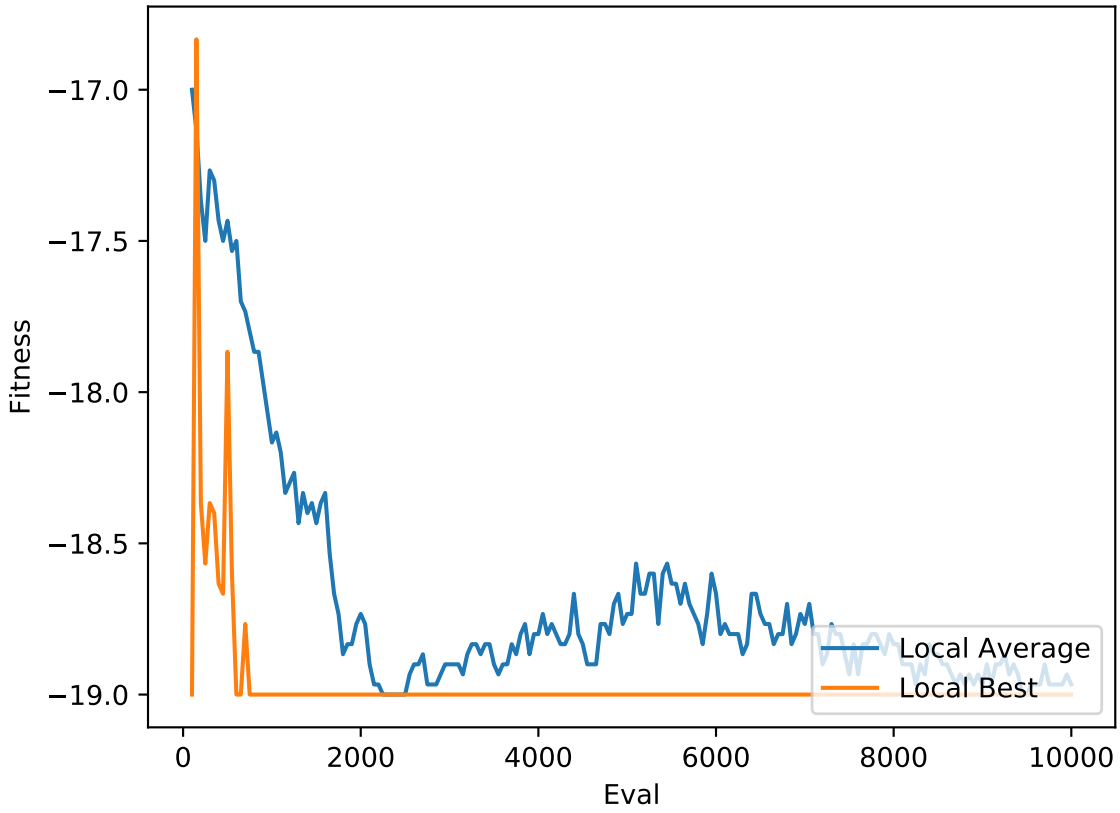

Figure 11: Figure 10 Representation

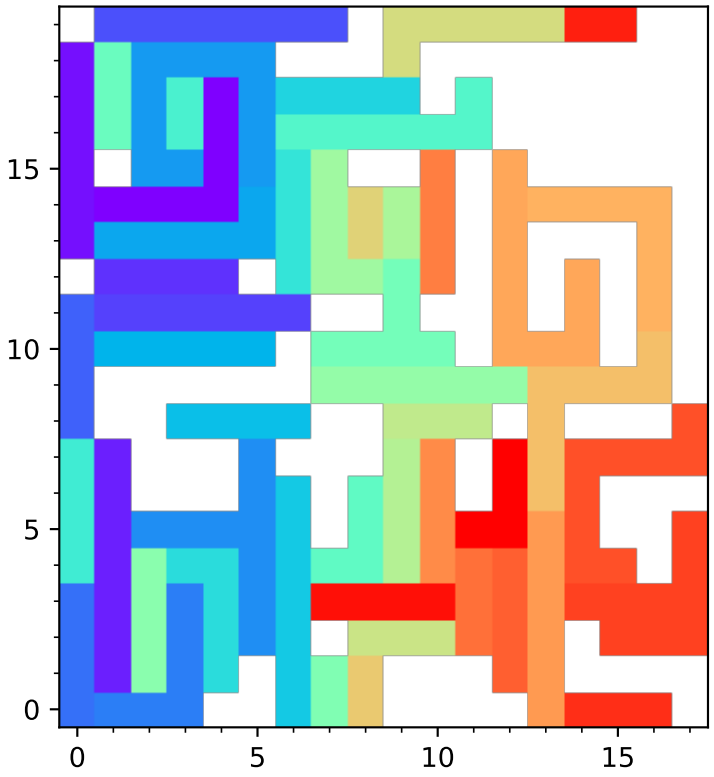

Figure 12: Input 1

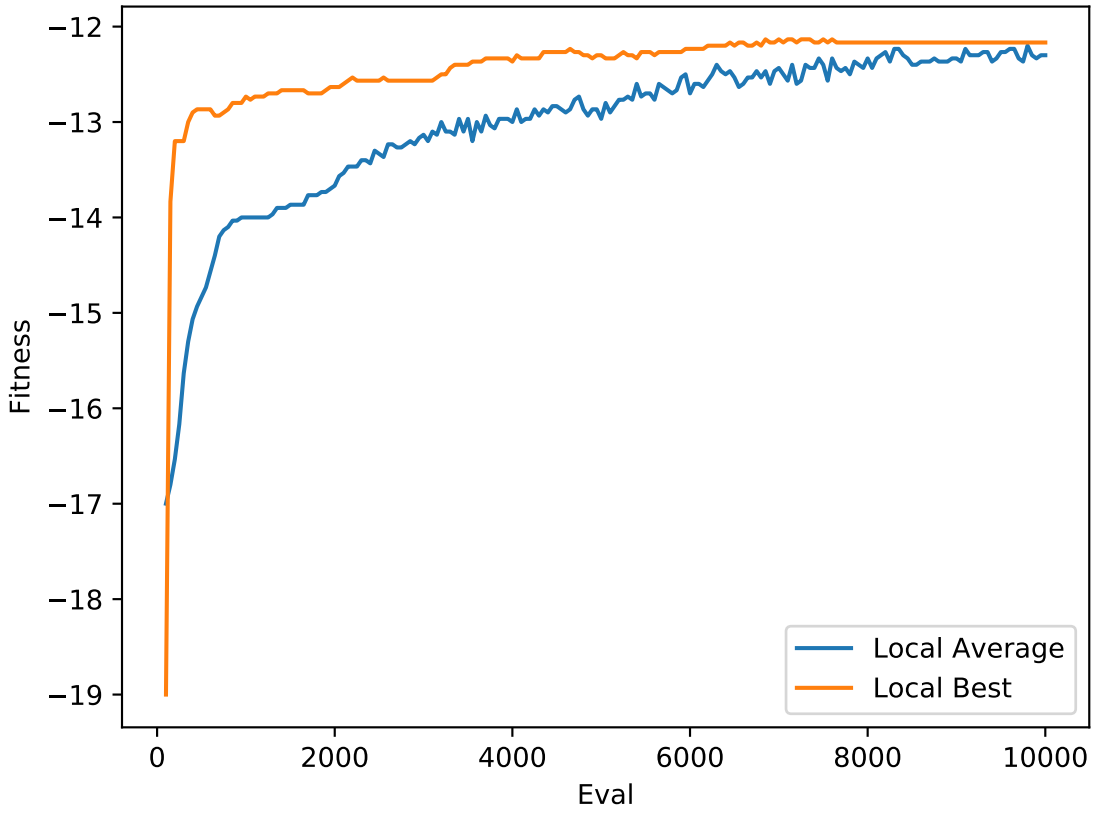

Figure 13: Figure 12 Representation

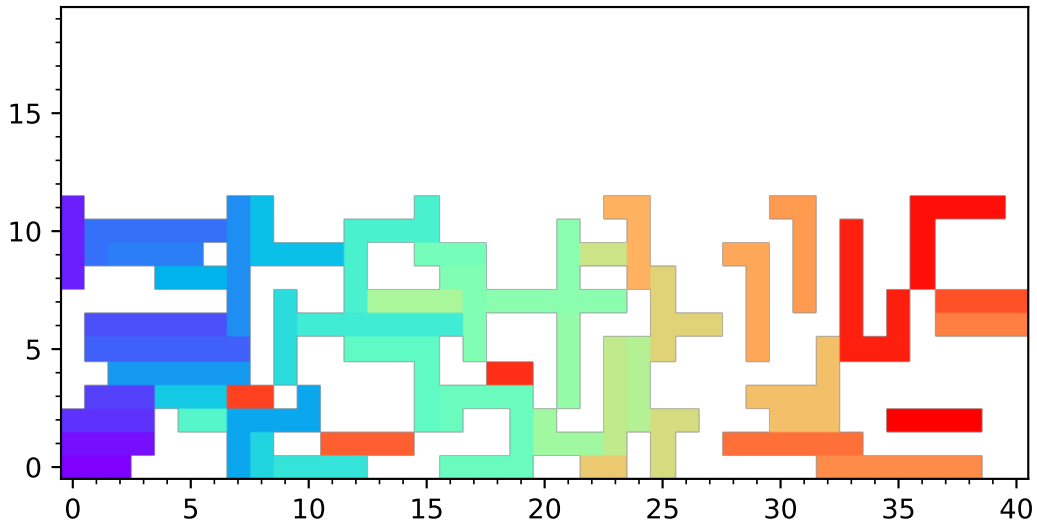

Table 7: Figure 14 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1007
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 8: Figure 16 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1008
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 14: Input 1

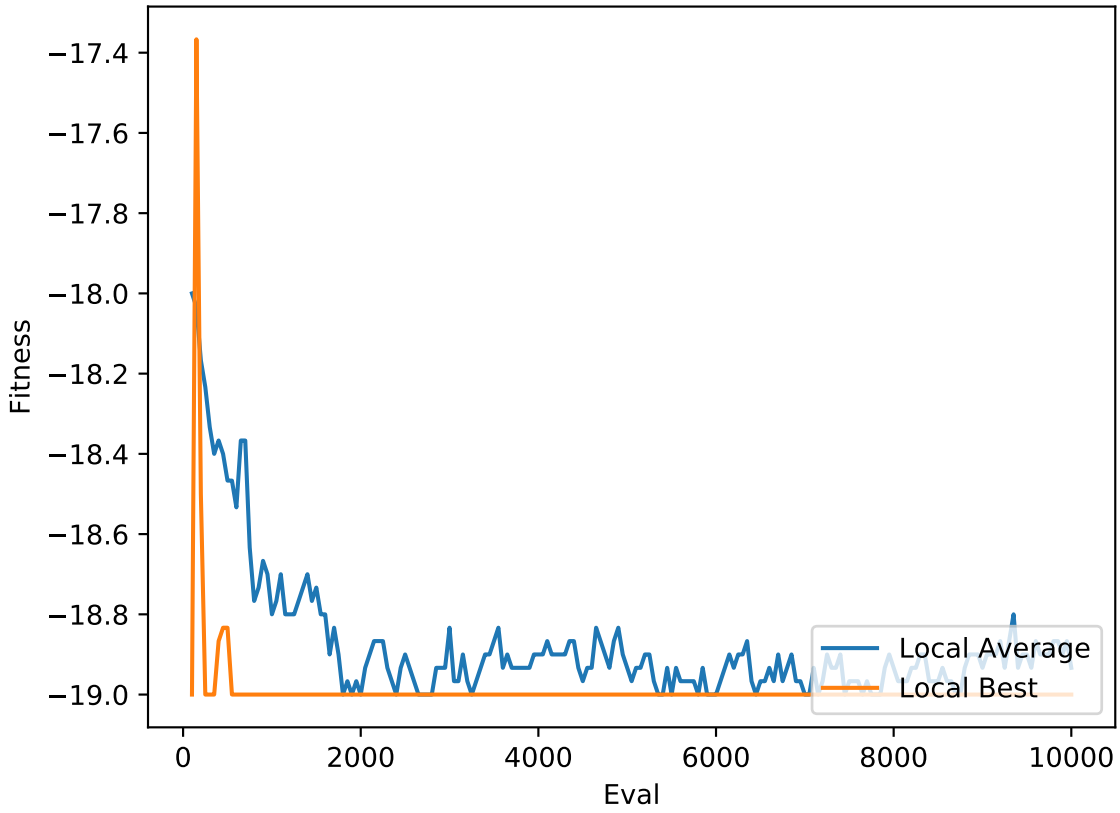

Figure 15: Figure 14 Representation

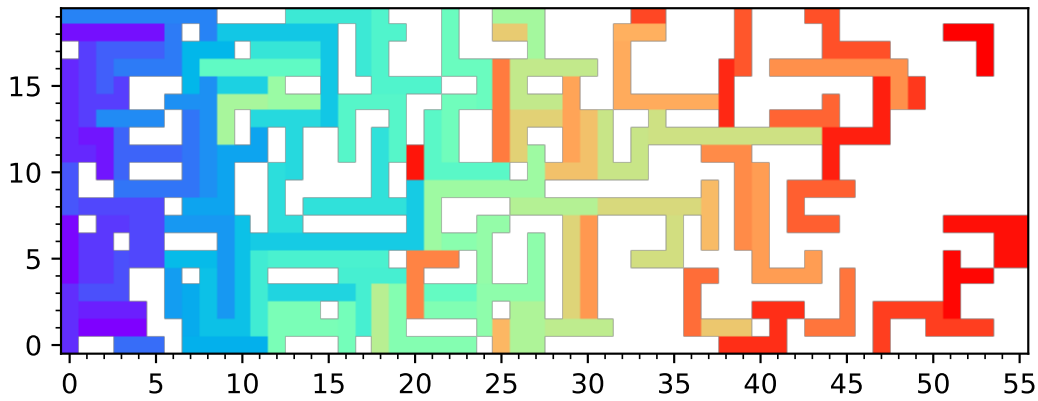

Figure 16: Input 1

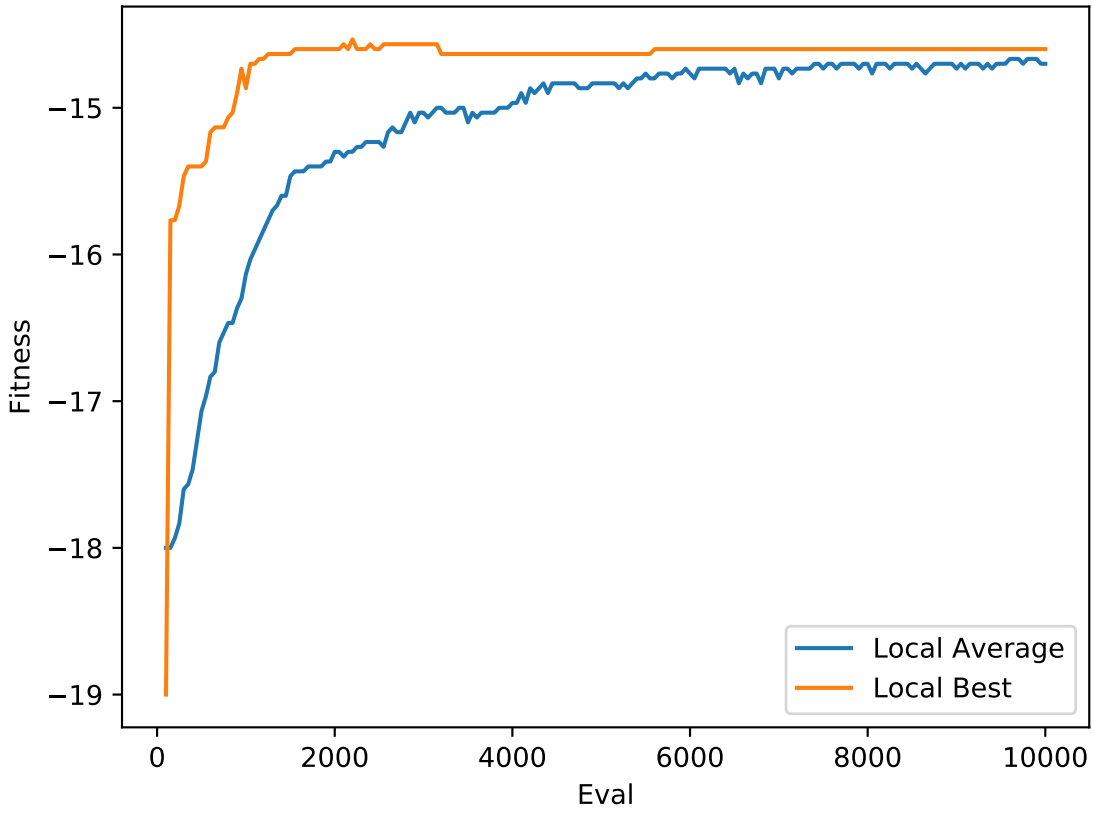

Figure 17: Figure 16 Representation

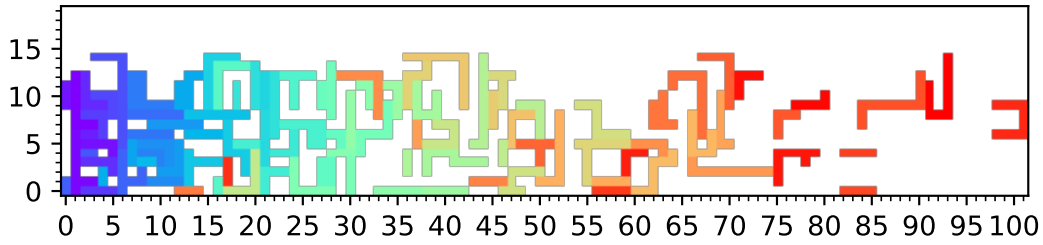

Table 9: Figure 18 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1009
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 10: Figure 20 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1010
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 18: Input 1

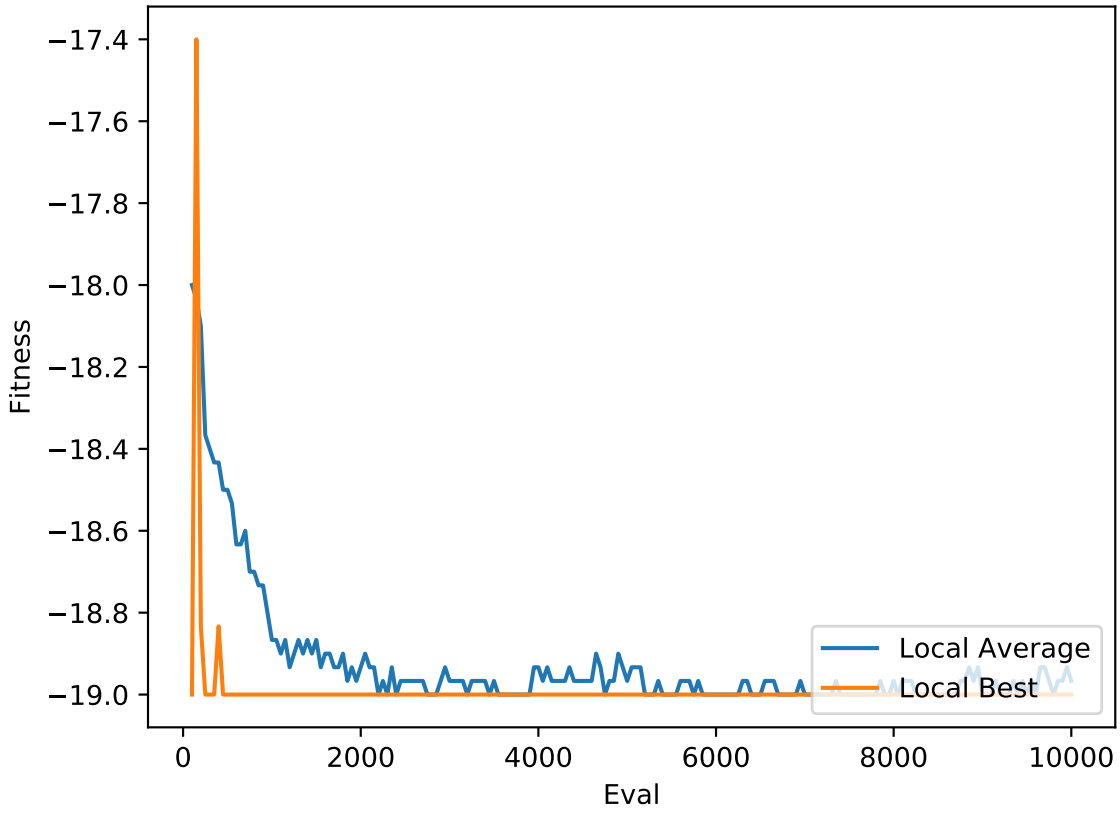

Figure 19: Figure 18 Representation

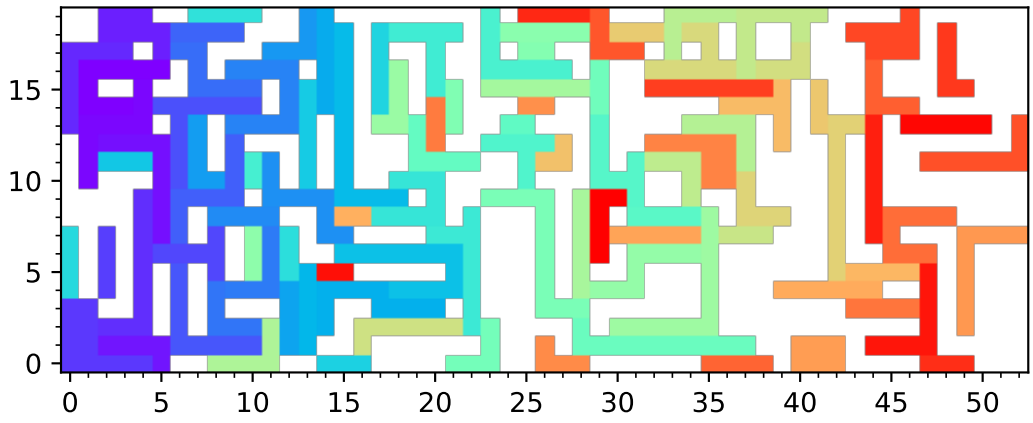

Figure 20: Input 1

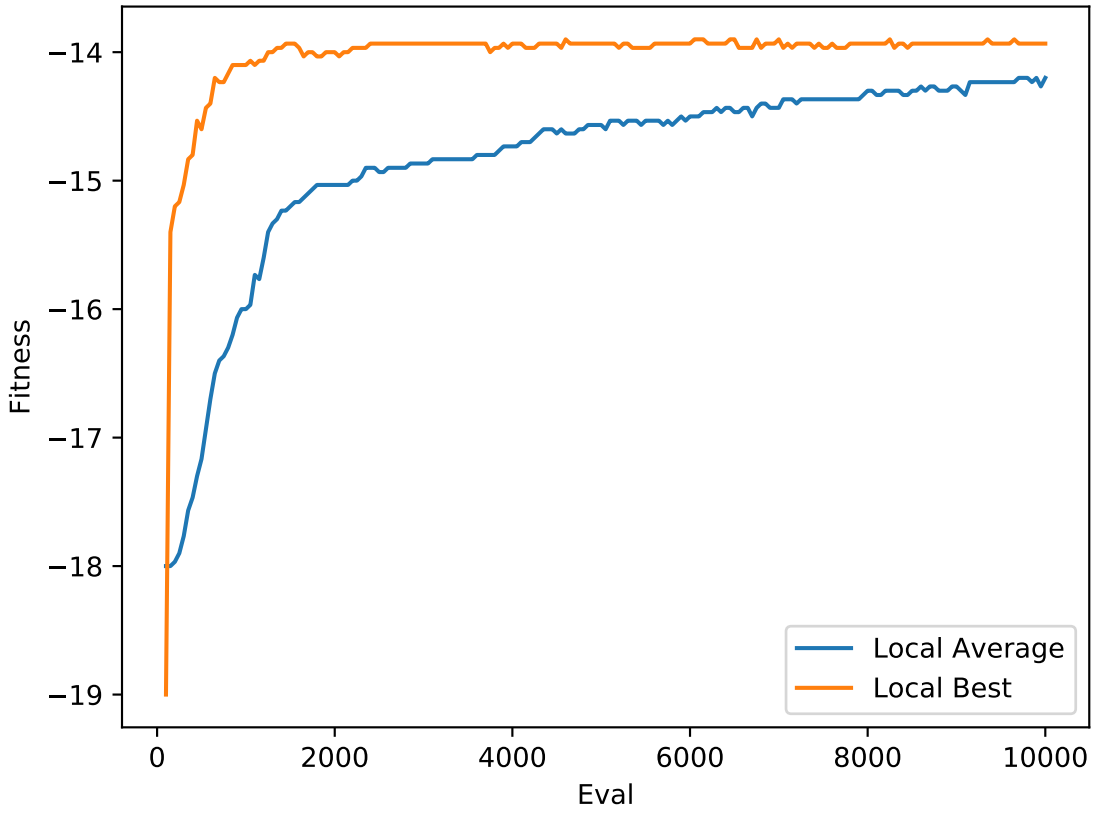

Figure 21: Figure 20 Representation

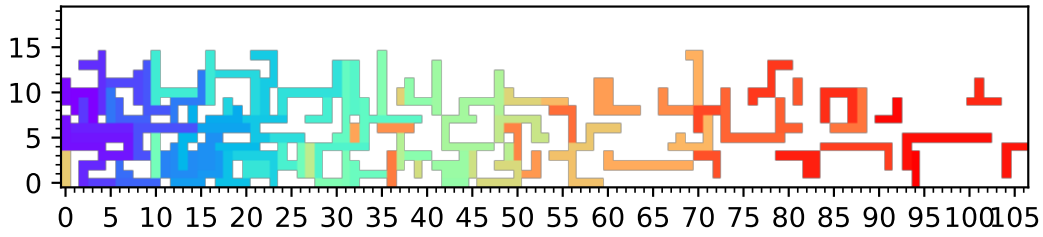

Table 11: Figure 22 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1011
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 12: Figure 24 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1012
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 22: Input 1

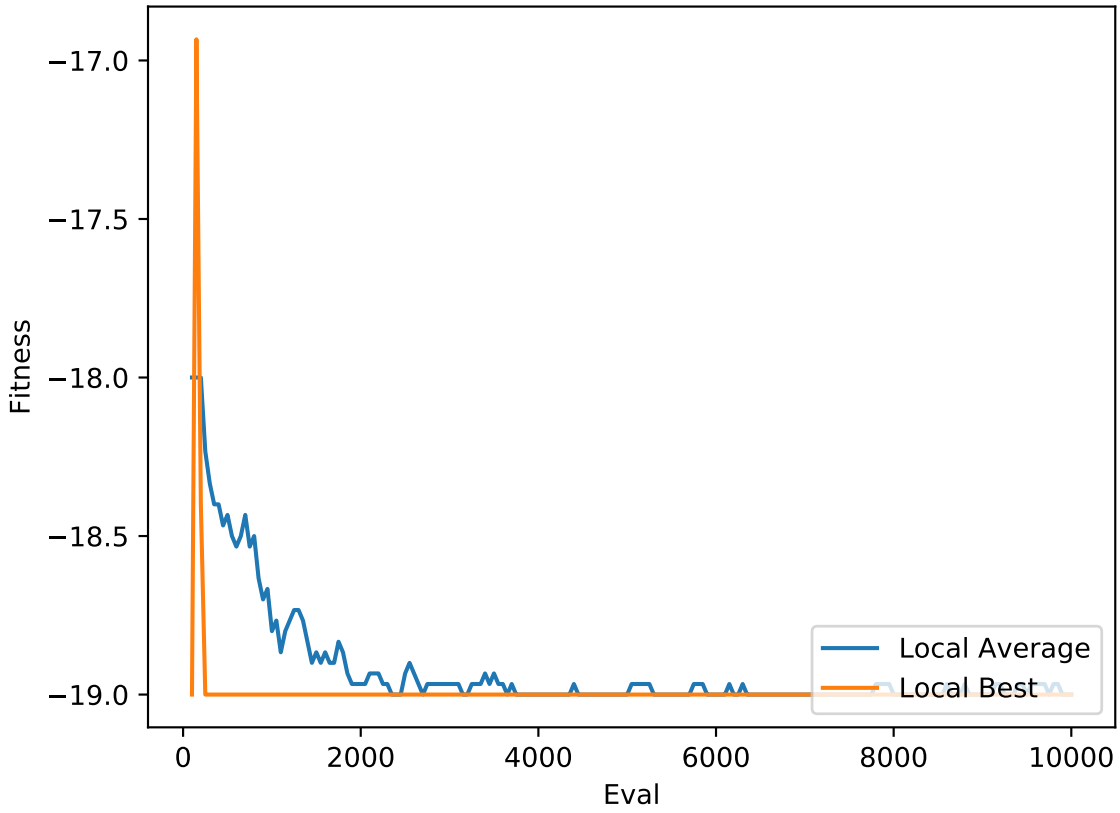

Figure 23: Figure 22 Representation

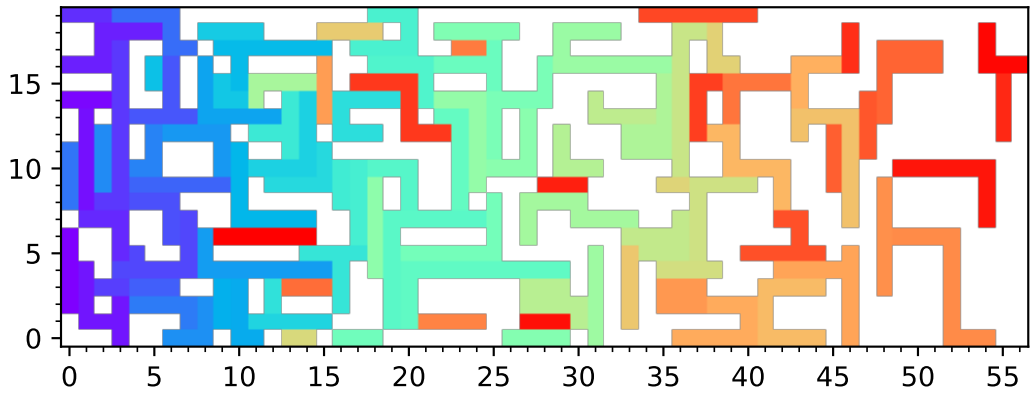

Figure 24: Input 1

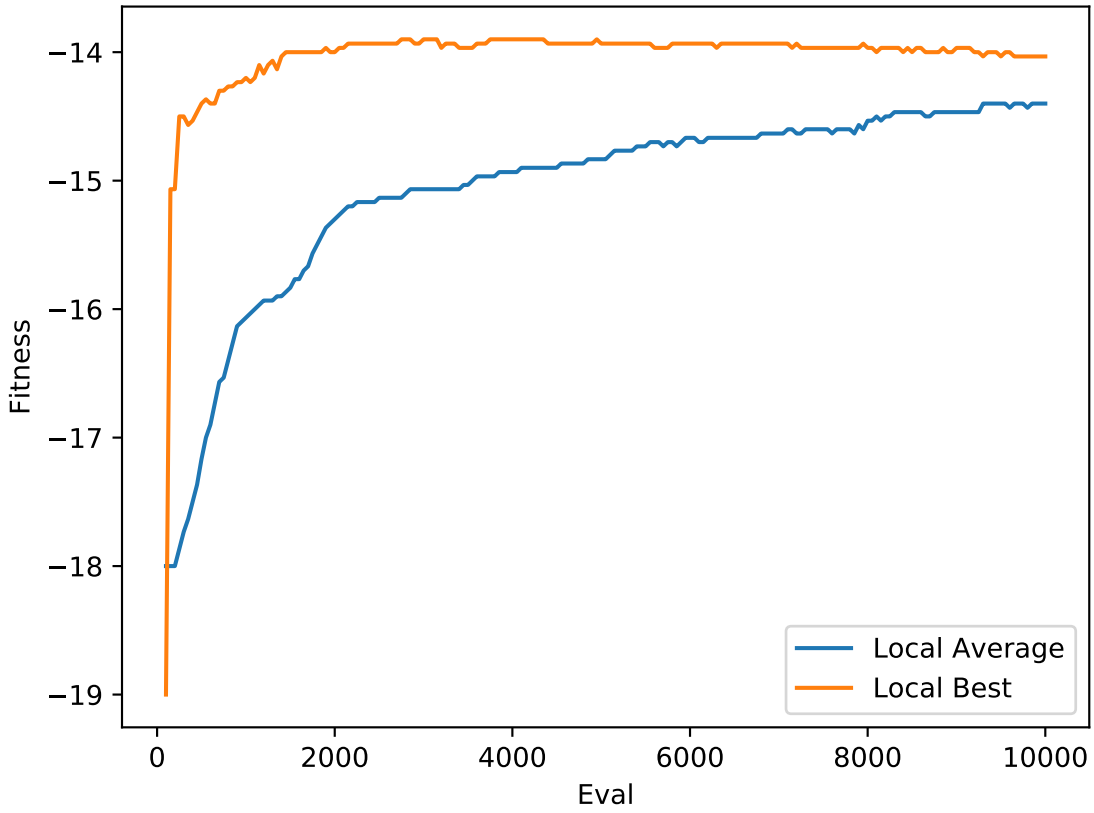

Figure 25: Figure 24 Representation

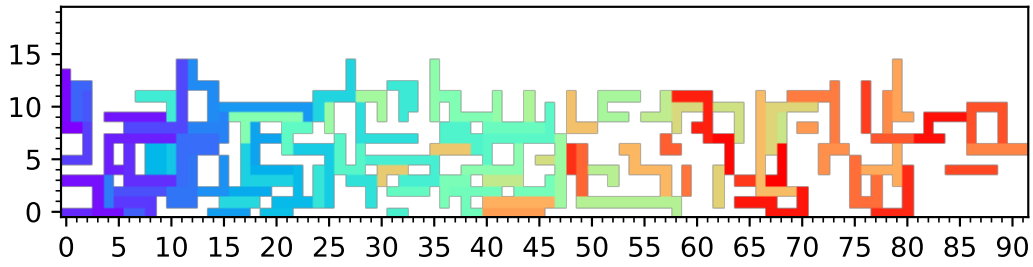

Table 13: Figure 26 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1013
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 14: Figure 28 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1014
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	k-Tournament Selection with replacement
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 26: Input 1

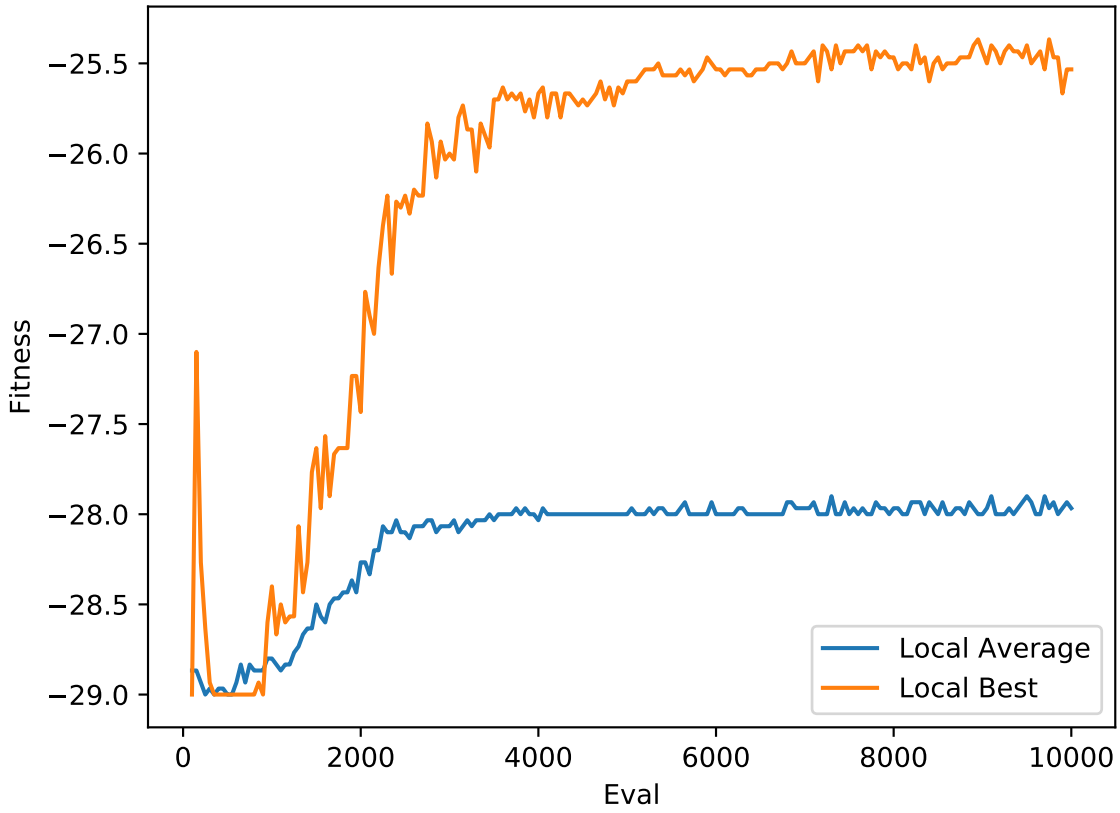

Figure 27: Figure 26 Representation

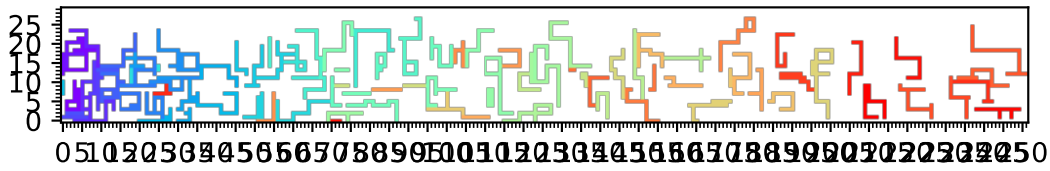

Figure 28: Input 1

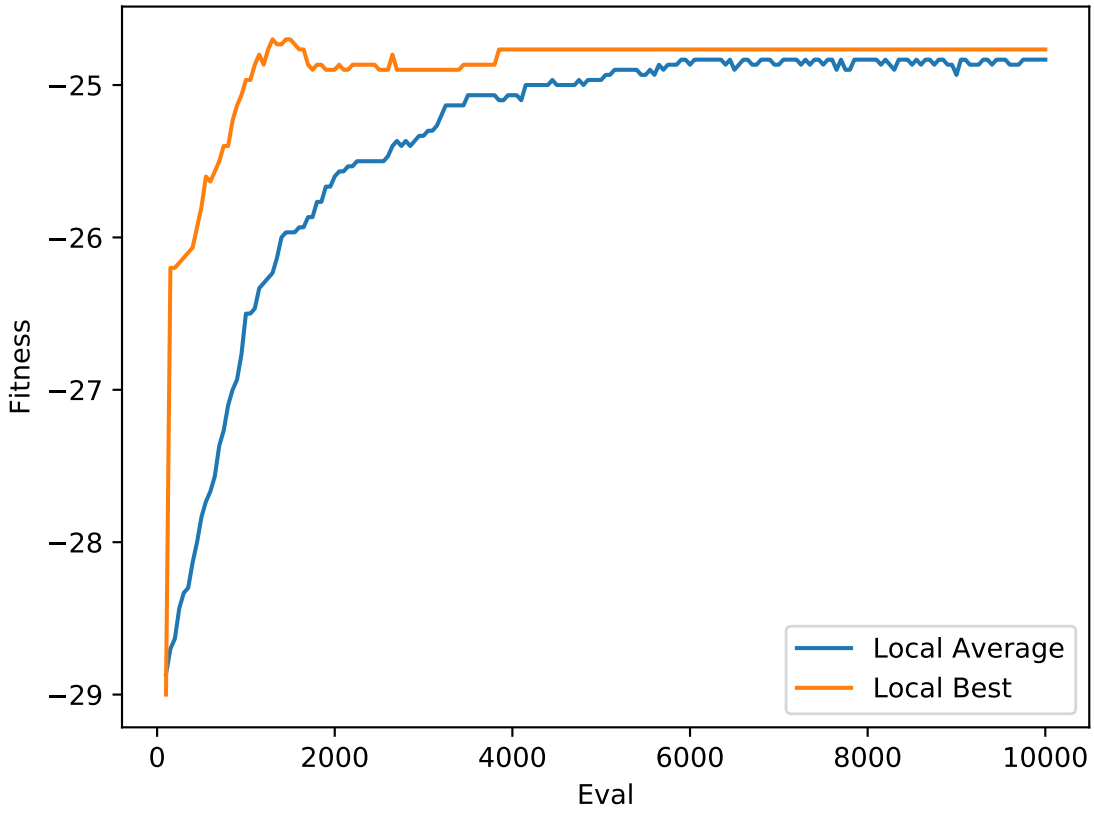

Figure 29: Figure 28 Representation

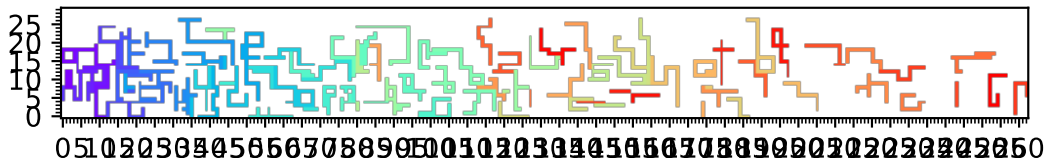

Table 15: Figure 30 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1015
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 16: Figure 32 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1016
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Fitness Proportional Selection
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 30: Input 1

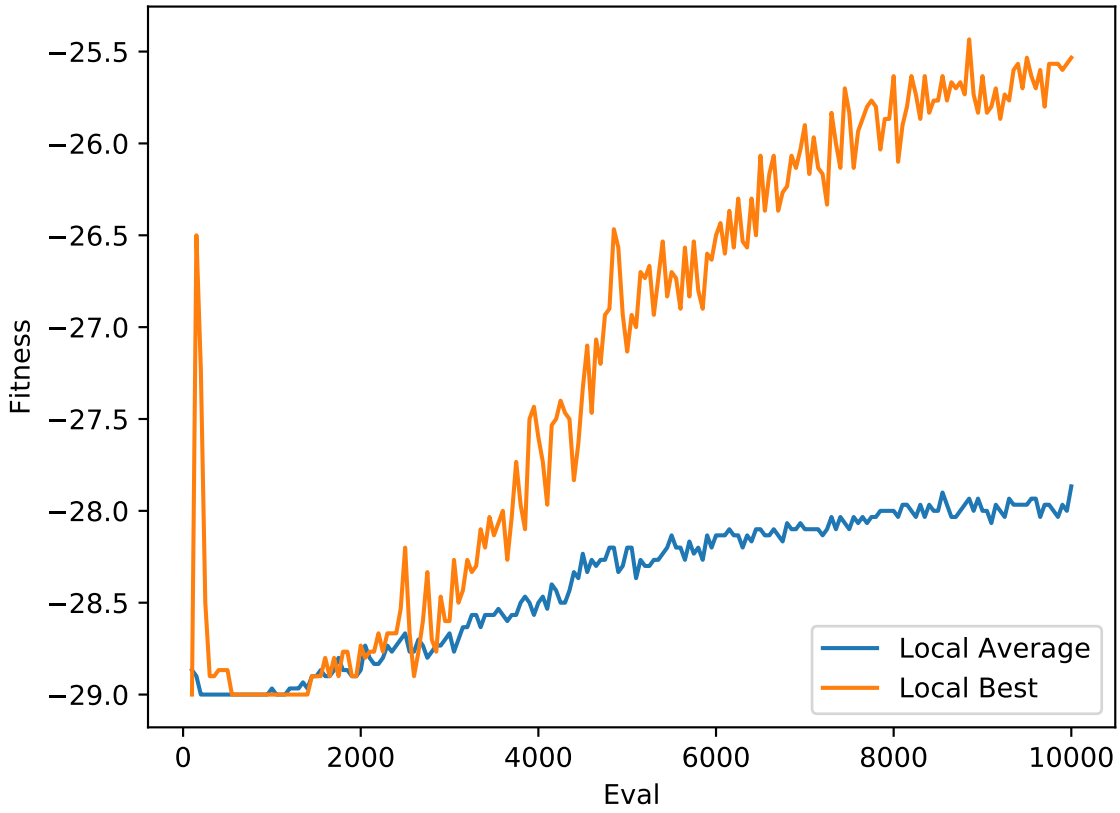

Figure 31: Figure 30 Representation

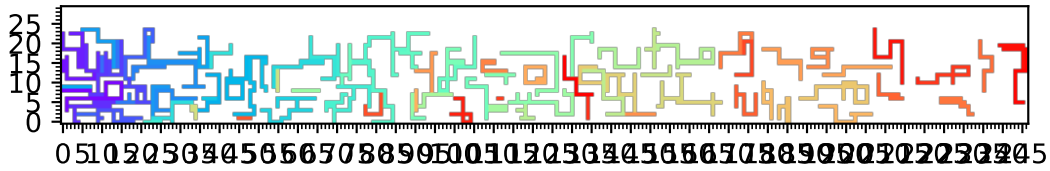

Figure 32: Input 1

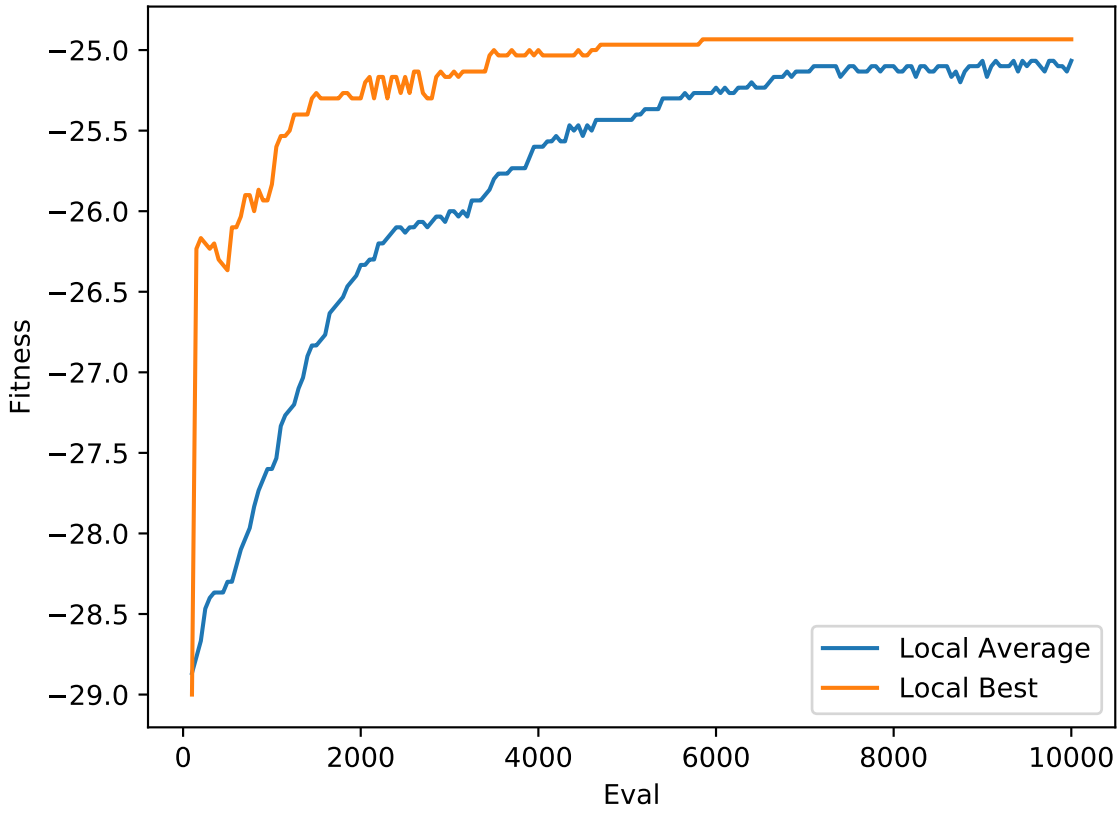

Figure 33: Figure 32 Representation

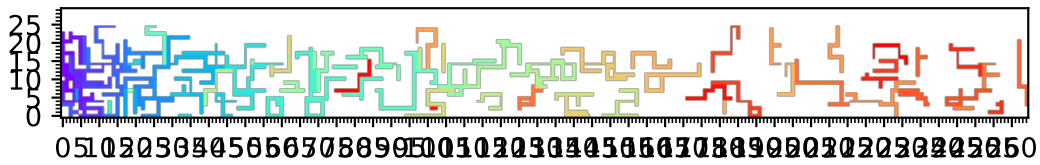

Table 17: Figure 34 Configuration File

Mutation Algorithm	Move
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1017
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Table 18: Figure 36 Configuration File

Mutation Algorithm	Flip
Fitness Evaluations	10000
Tournament Size For Survival Selection	5
Mutation Rate	0.1
Self Adaptive Penalty Coefficient	False
Random Seed	1018
Population Size	100
Placement Algorithm	Random
Termination Convergence Criterion	10000
Survival Strategy	Plus
Runs	30
Survivor Algorithm	Truncation
Offspring Count	50
Solution File Path	None
Self Adaptive Mutation Rate	False
Search Algorithm	EA
Parent Selection Algorithm	Uniform Random
Self Adaptive Offspring Count	False
Log File Path	None
MOEA	True
Recombination Algorithm	Partially Mapped Crossover
Tournament Size For Parent Selection	5
Penalty Coefficient	1

Figure 34: Input 1

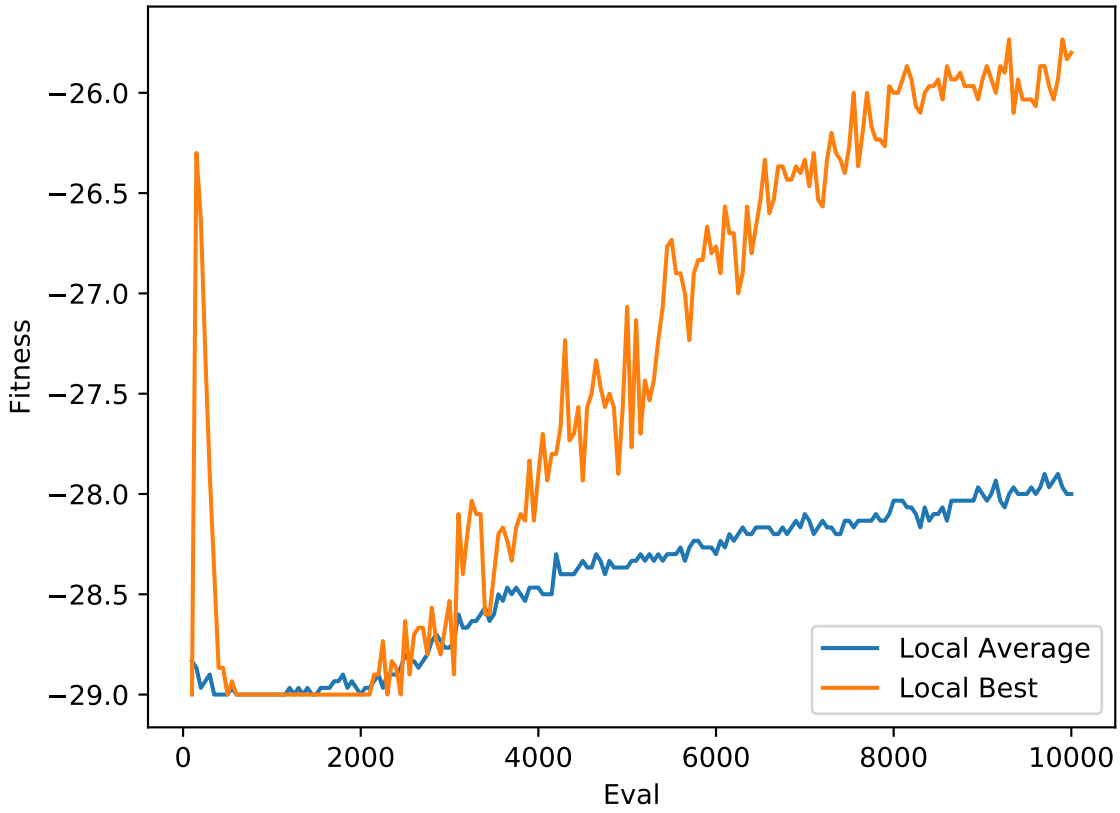

Figure 35: Figure 34 Representation

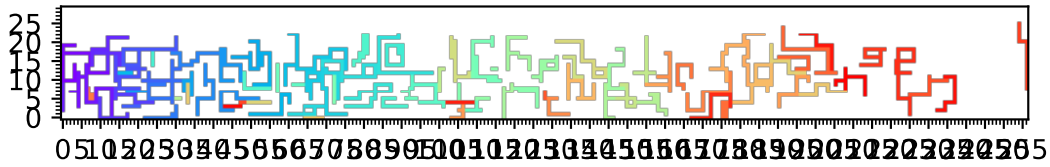

Figure 36: Input 1

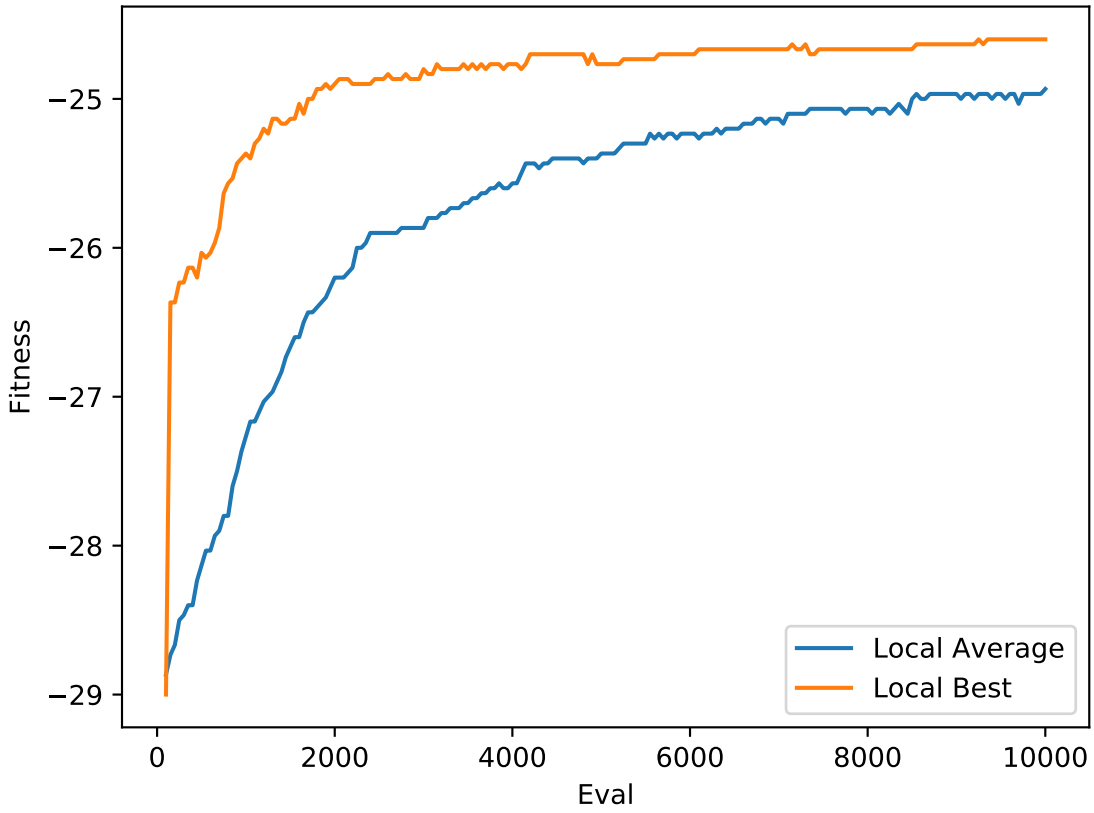

Figure 37: Figure 36 Representation