INVESTIGATION INTO PENALTY FUNCTIONS AND SELF ADAPTIVE VARIABLES

Compared to evolutionary algorithms implementing neither

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Computer Science 5401 FS2017 | Assignment 1c

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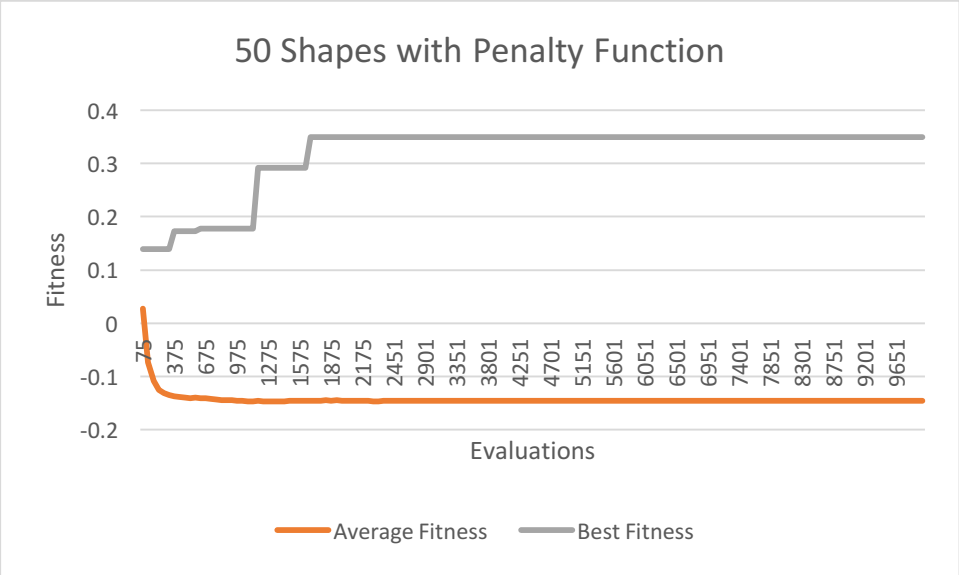
Investigation of the Use of a Penalty Function

The primary objective of the investigation into penalty functions is to determine if there is a significant impact on the quality of solutions output by the evolutionary algorithm as compared to an evolutionary algorithm that does not implement a penalty function. The investigation should consider that different problem sets may lend themselves more or less to a penalty function than other problem sets, as well as the configuration of EA parameters such as the penalty coefficient.

50 Shapes Problem Instance



F-Test Two-Sample for Variances

	No Penalty Function	*Penalty Function*
Mean	0.379555423	0.280047847
Variance	0.026427848	0.004227752
Observations	30	30
df	29	29
F	6.251041107	
P(F<=f) one-tail	2.05947E-06	
F Critical one-tail	1.860811435	

From the F-Test two sample for variance listed above, we can see that the F value (6.45) is greater than the F-Critical value (1.86) and variable 1's mean is greater than variable 2's mean. Based on these observations, we have to continue the investigation assuming unequal variances.

t-Test: Two-Sample Assuming Unequal Variances

	No Penalty Function	*Penalty Function*
Mean	0.379555423	0.280047847
Variance	0.026427848	0.004227752
Observations	30	30
Hypothesized Mean Difference	0	
df	38	
t Stat	3.1128763	
P(T<=t) one-tail	0.001755852	
t Critical one-tail	1.68595446	
P(T<=t) two-tail	0.003511705	
t Critical two-tail	2.024394164	

As seen in the t-test for unequal variances shown above, the t stat value is greater than the t critical two-tail value. Given this information, we should reject the null hypothesis that mean difference is zero and conclude that the variable with the better mean is a statistically better algorithm on the 50 shapes problem instance. Because the algorithm not using a penalty function has the higher mean, we can conclude that for this problem instance the algorithm without a penalty function is statistically better.