

A quality diversity study in EvoDevo processes for engineering design -Supplementary material-

Edgar Buchanan, Simon Hickinbotham, Rahul Dubey, Imelda Friel,
Andrew Colligan, Mark Price, and Andy M. Tyrrell

March 2024

1 Consistency analysis

A consistency analysis study was performed to identify the appropriate number of replicates to minimize the uncertainty introduced by the stochastic nature of the experiments. Figure 1 shows that any number above 15 is enough to have a reliable interpretation of the results.

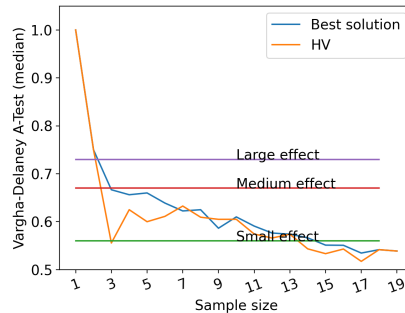


Figure 1: Consistency analysis.

2 Robustness analysis

The objective of the robustness analysis is two-fold: (1) to identify key parameters to the system and (2) to identify the best values for the key parameters.

Table 1 summarizes the data analysed and concludes that the number of emitters is not relevant for the implementation of CMAES-MapElites. The grid size parameter is important for the total exploration space and QD score metrics. The sigma parameter is important for the best solution and HV metrics.

Table 1: Key relevant parameters for CMAES-MapElites. o represents that different values for this parameter provide significant different results with this metric. x represents that different values for this parameter has no significant difference in the outputs.

Parameter	Best solution	HV	Exp space	QD
Emitters	x	x	x	x
Grid size	x	x	o	o
Sigma	o	o	x	x

Figure 2 shows the robustness analysis for the grid size parameter. The left figure highlights that the calibration of this parameter can lead a large difference in results for the space covered. The right figure shows that the best values for the grid size parameter is 50x50.

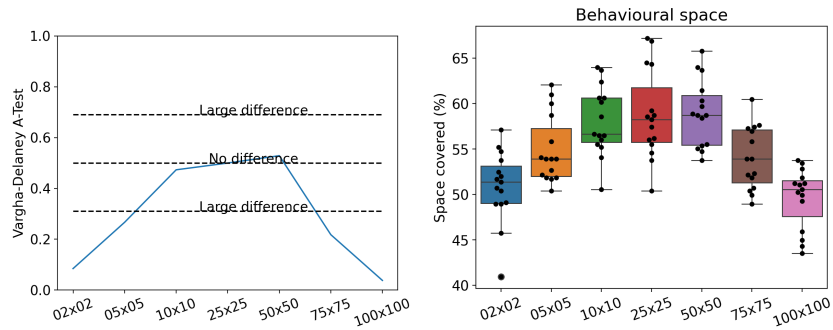


Figure 2: Robustness analysis: grid size.

Figure 3 shows the robustness analysis for the sigma parameter. The left figure highlights that the calibration of this parameter can lead a large difference in results for the HV metric. The right figure shows that the best values for the sigma parameter is 0.8.

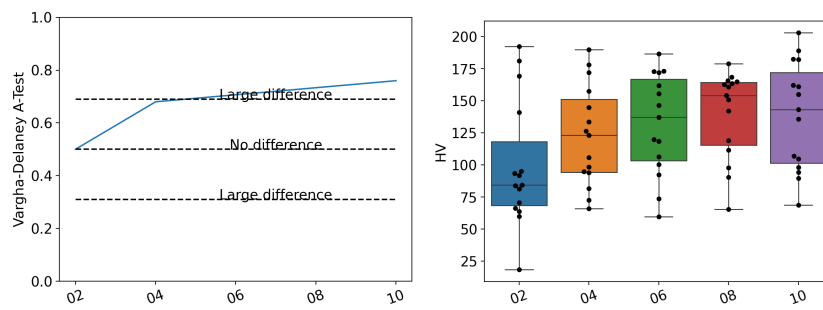


Figure 3: Robustness analysis: sigma. Please note that the values shows in the x-axis should be divided by ten.