A Genetic Algorithm-Specific Test of Random Generator Quality

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Abstract

It has been shown in past research that pseudo-random number generator (PRNG) quality can impact the performance of simple genetic algorithms (GAs). However, standard empirical tests of random generator quality are not good predictors of when such impacts are likely to occur. In this paper, we introduce a new test of random generator quality, tailored to specific instances of a simple GA. This test has been shown to be a better predictor of GA performance impacts than standard empirical tests.

1 PRNG QUALITY AND GA PERFORMANCE

Past research has shown that the pseudo-random number generator (PRNG) chosen can impact the performance of evolutionary algorithms, and genetic algorithms (GAs) in particular. However, standard empirical PRNG quality evaluation tests are not able to fully predict when such impacts might occur.

In recent experiments, we evaluated PRNGs of varying quality levels using the Diehard test suite [Marsaglia, 1993]. We then used these PRNGs to drive a simple GA over a test suite of 42 problems [Meysenburg et al., 2002]. We found that Diehard gave false positive results: the suite predicted that the RANDU PRNG would cause unusual GA performance, but in fact such performance differences were not detected.

To correct this problem, we developed a PRNG quality test tailored specifically to the way our GA uses randomness. This test considers every decision made by the PRNG during a GA run, except for population initialization. The test uses a PRNG to make all of the decisions that would be made during an actual GA run, in the same order in which they would be made. Counts are kept of each possible outcome of every decision, and then compared to counts that would be expected from truly random sources.

We have found this new test to be more predictive for GA use than the standard Diehard suite. In particular, our new test was able to identify the PRNG that did cause unusual performance in our experiments, without the false positive behavior of the Diehard suite.

In conclusion, we feel that our new test of PRNG quality, tailored to the specific way that randomness is used in an actual GA, can be used by GA practitioners in order to choose PRNGs suited for their experiments.

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