geneticalgs

Implementation of standard, migration and diffusion models of genetic algorithms (GA). Benchmarking was conducted by COCO platform `v15.03`.

Implemented features

- standard, diffusion and migration models
  - with real values (searching for global minimum or maximum of the specified function)
  - with binary encoding combination of some input data
- old population is completely replaced with a new computed one at the end of each generation (generational population model)
- two types of fitness value optimalization
  - minimization
  - maximization
- three parent selection types
  - roulette wheel selection
  - rank wheel selection
  - tournament
- may be specified mutation probability
- may be specified any amount of random bits to be mutated
- may be specified crossover probability
- different types of crossover
  - single-point
  - two-point
  - multiple point up to uniform crossover
- elitism may be turned on/off (the best individual may migrate to the next generation)

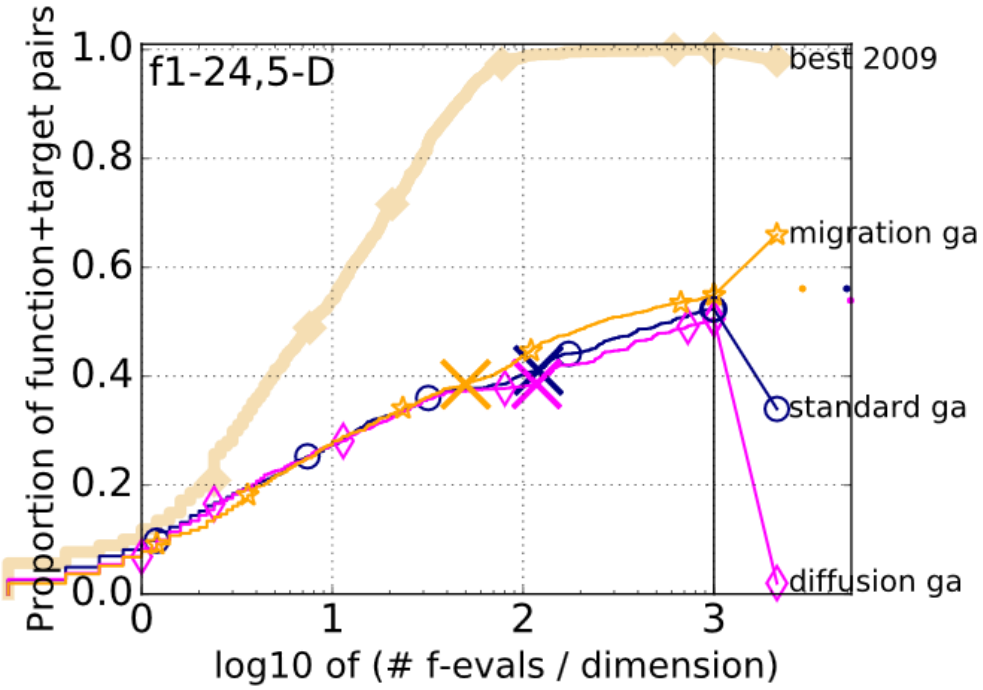
Results of benchmarking

Benchmarking was conducted using COCO platform on the 24 noiseless test functions. The subsections below contain results of Empirical Cumulative Distribution Functions (ECDFs)of all test functions for dimensions 5 and 20.

ECDFs per all functions for dimension 5

Bootstrapped empirical cumulative distribution of the number of objective function evaluations divided by dimension (FEvals/DIM) for all functions and subgroups in 5-D. The targets are chosen from $10^{[-8..2]}$ such that the bestGECCO2009 artificial algorithm just not reached them within a given budget of k × DIM, with k ∈ {0.5, 1.2, 3, 10, 50}. The "best 2009" line corresponds to the best ERT observed during BBOB 2009 for each selected target.

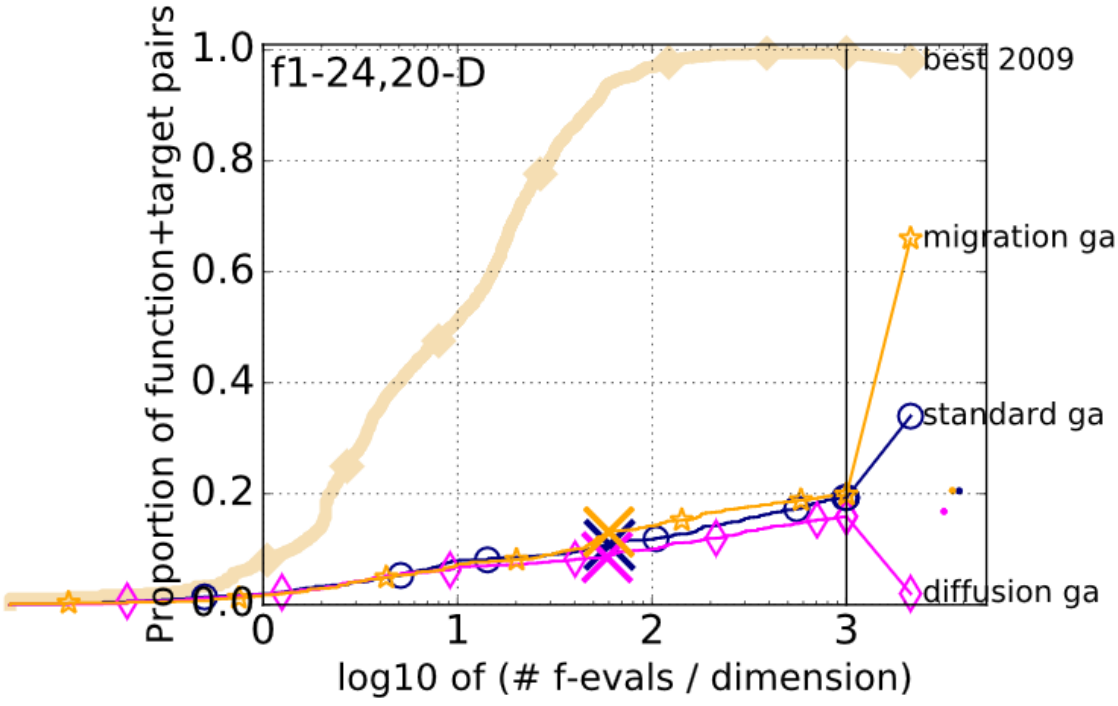
All functions



ECDFs per all functions for dimension 20

Bootstrapped empirical cumulative distribution of the number of objective function evaluations divided by dimension (FEvals/DIM) for all functions and subgroups in 20-D. The targets are chosen from $10^{[-8..2]}$ such that the bestGECCO2009 artificial algorithm just not reached them within a given budget of k × DIM, with k ∈ {0.5, 1.2, 3, 10, 50}. The "best 2009" line corresponds to the best ERT observed during BBOB 2009 for each selected target.

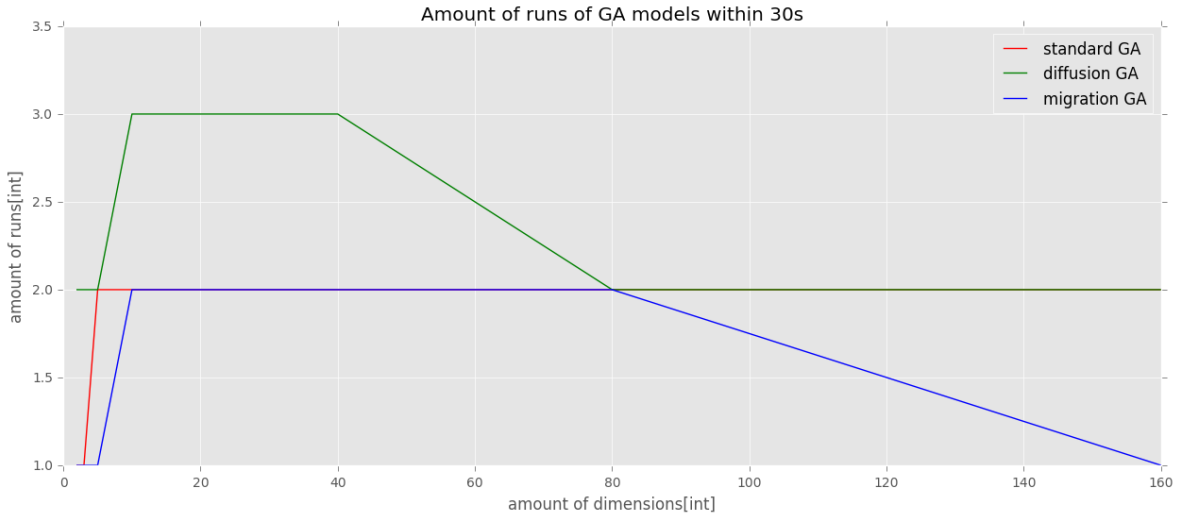
All functions



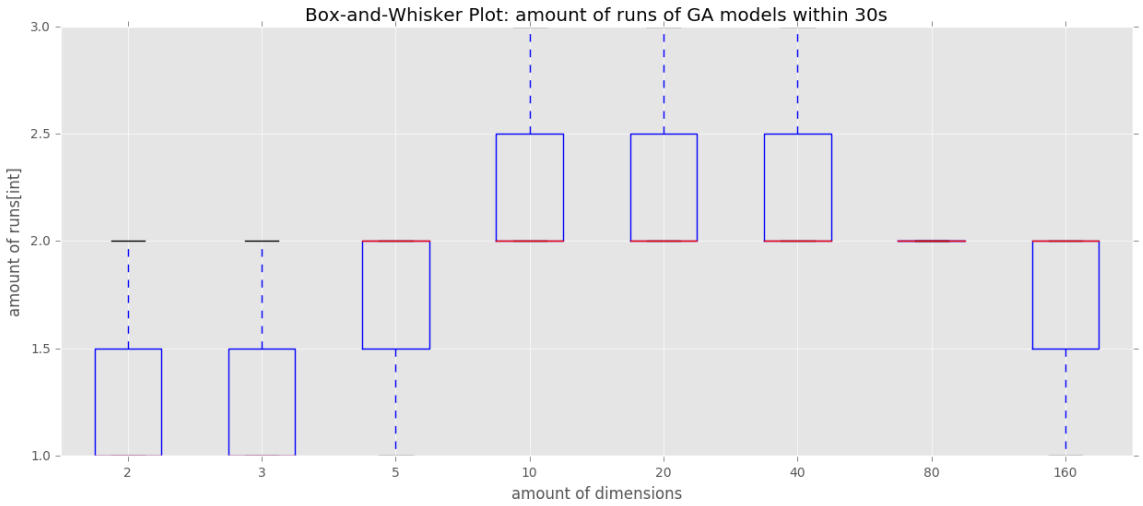
Time complexity

Time complexity was measured also with already prepared template exampletiming.py. The appropriate plots are shown below.

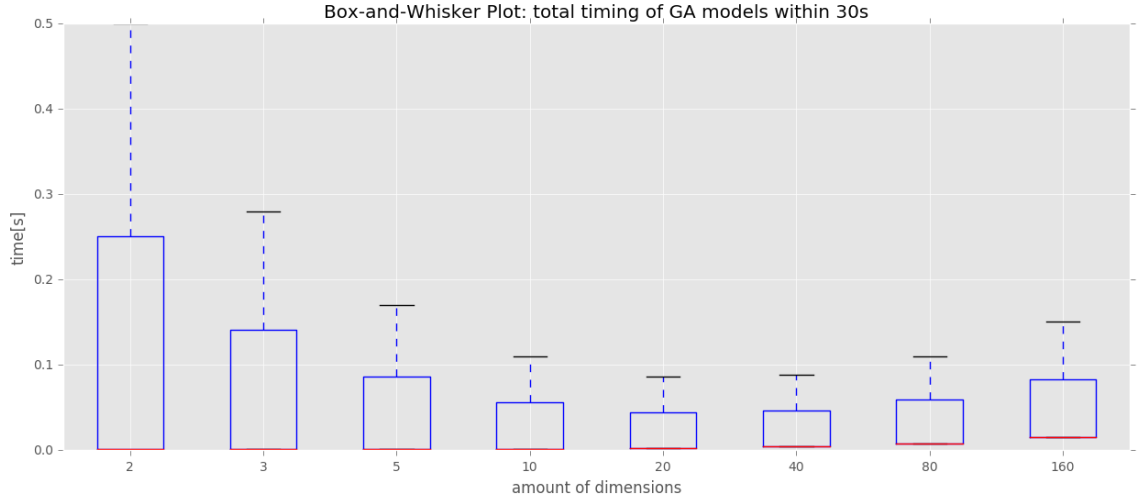
The following plot shows that the fastest implemented model of GAs is *diffusion model*. And the slowest one is *migration model* for dimensions greater than 80.



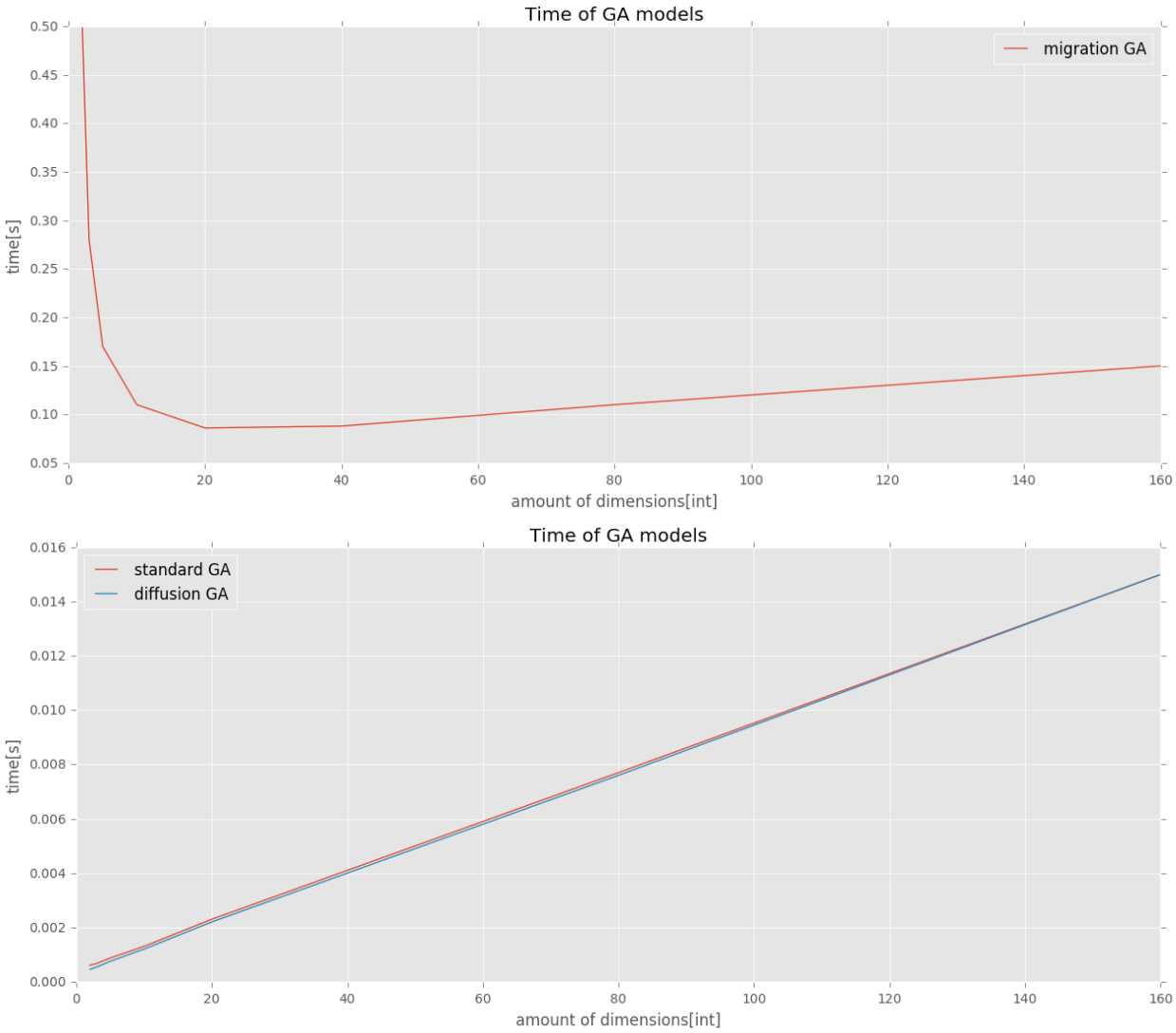
The plot below shows Box-and-Whisker plot of amount of runs of all implemented models of genetic algorithms (standard, diffusion, migration) per appropriate dimension.



The following plot shows Box-and-Whisker plot of total timing of all implemented models of genetic algorithms (standard, diffusion, migration) per appropriate dimension.



And the plots below show timing of particular models of genetic algorithms.



Conclusion

It is evident after the conducted benchmarking using COCO platform that *migration model* shows the most precise results among other implemented models. On the other hand, this model is the slowest one.

The fastest model is *diffusion* one.

The standard genetic algorithm shows average results among other models.