

Martin Stefan Krejca – Scientific Report

This report is submitted for approval by the STSM applicant to the STSM coordinator.

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STSM Title: Understanding Estimation-of-Distribution Algorithms under Noise in Theory and Practice

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Grantee name: Martin Krejca

The aim of my short term scientific mission (STSM) was to better understand estimation-of-distribution algorithms (EDAs) in noisy scenarios, i.e., scenarios where the value of the objective function cannot necessarily be trusted. Thus, we started investigating two papers I was part of that dealt with noise. We came to the conclusion that the parameter choice for an algorithm in a noisy scenario is a very important and highly non-trivial aspect. The two aforementioned papers cope with that aspect in a limited sense in a way that the run time bound – and, hence, basically the objective function – has to be known in advance. This is dissatisfactory, since a noisy scenario implies dealing with uncertainties (even more than usual).

We first approached the problem of a satisfactory parameter search in a noisy scenario. We came up with a general scheme that allows for successful optimization without knowing the correct parameter values or the run time in advance by making use of several algorithms run in parallel. These results are very interesting and also relevant for practical problems, as picking the correct parameter is always a hard task. Our results even apply to unnoisy scenarios. Since we had satisfiable results early on, we were considering further problems.

Inspired by the question of parameter search, motivated by noisy optimization, we settled on algorithms that adjust their parameters during the optimization process themselves. This approach has been popular for classical evolutionary algorithms (EAs) for some years now but has not been transferred to EDAs yet. The idea of self-adjusting algorithms also concerns parameter search. However, it is different from our first approach: in our initial setting, each run only makes use of a single parameter value; this may be insufficient in order to succeed. Our second setting tries to circumvent this problem by making use of algorithms that adjust their parameters on the fly. Most time of my STSM was spent discussing, designing, and analyzing algorithms for this scenario. The results we came up with look very promising.

Third, we were discussing lower bounds of EDAs in unnoisy settings – a topic that has sparked interest recently with not too many results published. Unfortunately, we did not have enough time to come to a satisfactory conclusion on this topic.

Overall, I learned a lot during my two weeks in Paris. Not only did I gain insights into new and interesting topics, I also learned new techniques for analyzing randomized algorithms. Further, our research will most likely result in at least one paper. Thus, I think that this STSM was a full success and I am very glad for the opportunity provided by COST to have visited Professor Benjamin Doerr.