Curriculum Vitae of Carola DOERR (updated April 2022)

Personal Data

Name:	Doerr (formerly Winzen), Carola
Date of birth:	March 05, 1984, in Würselen, Germany
Nationality:	German
Family status:	Married, two kids (born 04/2013 and 09/2015)
Homepage:	http://www-ia.lip6.fr/~doerr/
Publications:	Complete list, Google Scholar profile, DBLP entry

Education

12/20	Habilitation à diriger des recherches (HDR) HDR manuscript. Jury members: Carlos Coello Coello, Christoph Dürr, Laetitia Jourdan, Jonathan E. Rowe, Günter Rudolph, Marc Schoenauer, Lothar Thiele, Carsten Witt.
01/10–12/11	Ph.D. studies in Computer Science (Dr.-Ing., with distinction, summa cum laude, PhD thesis) Max Planck Institute for Informatics and Saarland University, Germany Supervisor: Kurt Melhorn
10/03–08/07	Studies in Mathematics (Dipl.-Math., "very good", Kiel University, Germany
07/03	Abitur (best possible grade of 1.0, two awards), Konstanz, Germany
08/01–07/02	AFS Intercultural Programs High-School Exchange in Tobatí, Paraguay

Current and Previous Academic and Industrial Positions

since 10/13	Permanent researcher with the French National Center for Scientific Research (CNRS), affiliated with the LIP6 department of Sorbonne Université, Paris, France
10/12–09/13	PostDoc at LIAFA (now IRIF), Paris Diderot University, France (funded by the Alexander von Humboldt Foundation)
01/12–09/13	PostDoc at Max Planck Institute for Informatics, Germany, part-time after 10/12
01/10–12/11	PhD student at Max Planck Institute for Informatics, Germany
12/07–01/12	Business Consultant with McKinsey & Co., Munich office, Germany (on educational leave from 01/10, working part-time 10/11-01/12)
07/06–10/06	Internship with Deutsche Lufthansa AG, Frankfurt, Germany

Selected Awards, Distinctions, and Fellowships

2022	CNRS bronze medal
2021	Best Paper Award at IEEE Congress on Evolutionary Computation
2021	Best Paper Award at EvoApplications
2020	1st and 3rd prize at the NeurIPS 2020 black-box competition
2019	Nomination for the CNRS bronze medal
2016	Best paper award at ACM Genetic and Evolutionary Computation Conference (GECCO)
2014	Offer for an Independent Minerva Research Group Leadership Position (5 years, W2 equivalent) within the Max Planck Society (declined)
2013	Best paper award at GECCO
2013	Otto Hahn Medal of the Max Planck Society
2012–13	Feodor Lynen PostDoc fellowship of the Alexander von Humboldt foundation
2012–13	Offers for PostDoc fellowships by the German Academic Exchange Service (DAAD) and École Polytechnique (both declined)
2012–14	Selected participant in the Fast Track Program of the Robert Bosch Foundation as only Computer Scientist among the 20 awardees
2012	Best paper award at GECCO
2010–12	Google Europe PhD Fellowship
2010	Best paper award at GECCO
2004–07	Fellow of the Foundation of German Business (SDW), undergraduate stipend

Description of the Research Group

We are a small subteam within the Operations Research team at the Computer Science department LIP6 of Sorbonne Université. Our university is located in Paris city center (metro station Jussieu, next to the Seine river, in the 5th arrondissement).

Our research covers several aspects of heuristic optimization, ranging from the theoretical analysis of randomized search heuristics for discrete and numerical optimization problems over sound empirical benchmarking to applications of black-box optimization techniques in academic and industrial applications. Our current team members are:

- Carola Doerr (CNRS researcher)
- Martin Krejca (PostDoc, working on running time analysis of black-box optimization techniques)
- Elena Raponi (PostDoc, working on efficient optimization techniques for expensive high-dimensional problems in structural mechanics)
- Anja Jankovic (PostDoc/ATER, working on supervised learning techniques for automated algorithm selection and configuration)
- Alexis Robbes (PostDoc, working on modular algorithm frameworks and algorithm configuration)
- François Clement (PhD student, in co-supervision with Luís Paquete, working on subset selection for low-discrepancy point sets)
- Mara Santarelli (PhD student, in co-supervision with Institut Pasteur, working on the identification of resistant subpopulations in ovarian cancer using single-cell data)
- Océane Fouquet (PhD student, in co-supervision with Institut Pasteur, working on monotonic classifiers for systems biology)
- Maria Laura Santoni (Master student, working on Bayesian Optimization for high-dimensional optimization)

Together with Thomas Bäck and his team at Leiden University we develop and actively maintain IOHprofiler, a highly versatile benchmarking platform for the interactive performance evaluation and comparison of iterative optimization heuristics (IOHs).

We also have a strong collaborations with the development team of Facebook's Nevergrad benchmarking platform.

Our team regularly hosts visiting researchers and students, short- and long-term. See `http://www-ia.lip6.fr/~doerr/index.html#visitors` for a list of recent visitors.

Project Description

Development and Analysis of New Variation Operators for Randomized Search Heuristics

1 sentence summary: Motivated by recent works demonstrating untapped potential in the design of variation operators for randomized search heuristics, we suggest to analyze power and limits of generalized mutation operators.

Background: Randomized search heuristics are general-purpose optimization algorithms, designed to provide good solutions for problems that cannot be solved by exact approaches—for example, because the quality of the solution candidates can only be assessed through simulations or physical experiments or because we lack the time or the knowledge to design a problem-tailored solution.

Variation operators are a key component of randomized search heuristics. They determine how new solution candidates are generated from previously evaluated ones. Variation operators differ in how they balance the trade-off between small local moves with decent probability of improving over the current-best solution and riskier sampling at larger distances, with the hope to identify more promising areas of the search space. Recent works indicate that state-of-the-art variation operators are too risk-averse, limiting the overall performance of randomized search heuristics [3, 1]. We also demonstrated that a de-coupling of the *expected* sampling distance from its *variance* can be advantageous, as it offers a finer control over the distributions and because it allows to dynamically converge from evolutionary algorithms to local search strategies and back [5].

Project Goals: The goal of this project is to design new variation operators for randomized search heuristics and to formally derive performance guarantees that are better than what can be achieved by state-of-the-art approaches. Depending on the student's interest, we can complement the performance guarantees with lower bounds, which we will derive via black-box complexity approaches [4]. Alternatively, we can work towards a formal analysis of adaptive mutation operator choices, building on works summarized in [2].

Student's Profile: This project addresses students with first experience in the formal analysis of randomized search heurstics. Background in algorithms, complexity, or mathematics is required.

However, I am open to adjust the outline above to empirical-"only" analysis of new variation operators. In this case, prior experience in benchmarking randomized algorithms is beneficial. The ideal candidate for an empirical project would bring experience in algorithm configuration.

References

[1] Maxim Buzdalov and Carola Doerr. Optimal static mutation strength distributions for the $(1+\lambda)$ evolutionary algorithm on OneMax. In *Proc. of Genetic and Evolutionary Computation Conference (GECCO'21)*, pages 660–668. ACM, 2021. doi:10.1145/3449639.3459389.

[2] Benjamin Doerr and Carola Doerr. Theory of parameter control mechanisms for discrete black-box optimization: Provable performance gains through dynamic parameter choices. In *Theory of Evolutionary Computation: Recent Developments in Discrete Optimization*, pages 271–321. Springer, 2020. Also available online at https://arxiv.org/abs/1804.05650.

[3] Benjamin Doerr, Huu Phuoc Le, Régis Makhmara, and Ta Duy Nguyen. Fast genetic algorithms. In *Proc. of Genetic and Evolutionary Computation Conference*, pages 777–784. ACM, 2017.

[4] Carola Doerr. Complexity theory for black-box optimization heuristics. In *Theory of Evolutionary Computation: Recent Developments in Discrete Optimization*, pages 133–212. Springer, 2020. Also available online at https://arxiv.org/abs/1801.02037.

[5] Furong Ye, Carola Doerr, and Thomas Bäck. Interpolating local and global search by controlling the variance of standard bit mutation. In *Proc. of IEEE Congress on Evolutionary Computation (CEC'19)*, pages 2292–2299. IEEE, 2019.