

PI 1: Thomas Bäck (cPI)

PERSONAL INFORMATION

Family name, First name: Bäck, Thomas
Researcher unique identifier(s): ORCID 0000-0001-6768-1478
Date of birth: 16 March 1963
Nationality: German
URL for web site: <https://www.universiteitleiden.nl/medewerkers/thomas-back>
Publications, citations: **276 publications, h-index: 54, > 26,000 citations**
<https://scholar.google.com/citations?user=x7LEID0AAAAJ>

I am a computer scientist by training, and **my academic work is multidisciplinary**. My work intersects strongly with biology (being the inspiration for global optimization algorithms gleaned from the model of organic evolution), engineering (being the source of design optimization problems from areas such as automotive, aerospace, ship design, and others), and business applications, giving me practical insights in improved optimization results (through my own industrial experience, solving hard optimization problems for industry).

In my work, I combine my interest in a deep, **fundamental understanding of algorithms** and their working principles with an empirical analysis of their results and my **curiosity for solving hard real-world problems**. I am inspired by trying to solve the apparently “unsolvable” practical problems (e.g., car safety optimization with more than one hundred parameters in less than two hundred simulation runs). Finding the best approach to solve such problems and understand its fundamental working principles is fascinating me and drives my research interest. Consequently, I am recognized worldwide as a **leading expert in developing advanced variants of evolutionary algorithms for solving the most challenging industrial optimization problems**, while at the same time striving for a solid scientific understanding of the foundations of algorithms.

Currently, my main interest is in **automatizing the algorithm development process** for new optimization algorithms, to ensure that the best possible optimization algorithm is created automatically, given a new optimization problem. The LION approach would allow me to further explore this new line of research.

My two NWO-funded projects and the EU Marie Curie Industrial Training Network (ITN) ECOLE are at the base of the ATOPGOAL ambition, since they are dealing with demanding practical optimization problems and advanced machine learning algorithms such as deep learning, advanced Gaussian processes, and efficient global optimization. They create a framework in which ATOPGOAL will be perfectly embedded, enabling the breakthrough research that builds on the output provided by these projects.

EDUCATION

1994 PhD, Department of Computer Science, University of Dortmund, Germany. Supervisor: H.- P. Schwefel, inventor of evolution strategies, the European paradigm in evolutionary computation (comparable to J. Holland, inventor of genetic algorithms). National **best dissertation award** in computer science 1995.
1990 Diploma in Computer Science (minor: Computational Chemistry), Department of Computer Science, University of Dortmund, Germany.

CURRENT POSITION

2019 – present Chief Scientist
2002 – present Full Professor of Computer Science, Faculty of Sciences, Leiden Institute of Advanced Computer Science (LIACS), Leiden University, Netherlands.

PREVIOUS POSITIONS

- 2015 – 2016 Visiting professor at the Key Lab of Intelligent Perception and Image Understanding of the Ministry of Education, Xidian University, Xi'an, China (Prof. Jing Liu).
- 2000 – 2010 Chief Scientist and President of NuTech Solutions GmbH, Dortmund, Germany, and Chief Technology Officer of NuTech Solutions, Inc., Charlotte, NC.

FELLOWSHIPS AND AWARDS

- 2015 IEEE Computational Intelligence Society (CIS) Evolutionary Computation Pioneer Award for contributions in synthesizing evolutionary computation. This is one of the most prestigious IEEE awards, with recipients such as John Holland, Hans-Paul Schwefel, etc. (see <http://cis.ieee.org/award-recipients.html>).
- 2003 Fellow of the International Society of Genetic and Evolutionary Computation (ISGEC) for fundamental contributions to the field.
- 1995 Best dissertation award of the “Gesellschaft für Informatik (GI)” (German Association for Computer Science).

SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

- 2002 – present 4 Postdocs / 14 PhD students graduated and 16 currently under supervision / 62 Master students (thesis supervision), LIACS, Leiden University, Netherlands

TEACHING ACTIVITIES

- 1996 – present Teaching courses every year in the Bachelor CS and Master CS and ICT in Business (all courses are 6 ECTS): 1) *Evolutionary Algorithms*, 2) *Natural Computing*, 3) *Swarm-Based Computation*, and 4) *Systems Development and Project Management*.

ORGANISATION OF SCIENTIFIC MEETINGS

- 1990 – present Organized and (co-)chaired major conferences including 1st, 2nd, 3rd IEEE Conference on Evolutionary Computation, 7th Int. Conference on Genetic Algorithms, 5th Int. Conference on Parallel Problem Solving from Nature, GECCO 2019 (Real-World Applications track co-chair).

INSTITUTIONAL RESPONSIBILITIES

- 2018 – present Deputy scientific director of LIACS, Leiden University, Netherlands.
- 2017 – present Advisor of the management team of LIACS, Leiden University, Netherlands.
- 2014 – present Member of the “Permanent Committee for Academic Practice (WECO)” of the Faculty of Science, Leiden University.
- 2007 – 2016 Director of education, LIACS, Leiden University, Netherlands (responsible for Bachelor and Master Computer Science, and Master ICT in Business).
- 2009 – 2013 Master student advisor, ICT in Business, LIACS, Leiden University, Netherlands.
- 2008 – 2013 Curriculum commission member, LIACS, Leiden University, Netherlands.

EDITORIAL ACTIVITIES

- 2019 – present Area Editor, *ACM Transactions on Evolutionary Learning and Optimization* (ACM).
- 2018 – present Editorial Board, *Journal of Intelligent Manufacturing* (Springer).
- 2018 – present Co-editor-in-chief of the *Natural Computing* book series (Springer).
- 2018 – present Co-editor-in-chief, *Theoretical Computer Science – C* (Elsevier, Amsterdam).
- 2013 Co-editor, *Handbook of Natural Computation* (Springer, Berlin).
- 2007 – 2018 Associate editor, *Theoretical Computer Science – C* (Elsevier, Amsterdam).
- 2001 – present Evolutionary Computation Area editor, *Natural Computing Journal* (Springer).
- 1999 – 2018 Co-editor of the *Natural Computing* book series (Springer).

MAJOR COLLABORATIONS (SELECTION)

- **Prof. Daniel Tauritz** (Auburn University, AL): Hyper-heuristics and genetic programming.
- **Prof. Xin Yao** (Univ. of Birmingham and SUSTECH, Shenzhen): Evolutionary computation.
- **Prof. Heike Trautmann** (Univ. of Münster, D): Exploratory landscape analysis.
- **Dr. Carola Doerr** (Sorbonne Univ., F): Theoretical foundations and benchmarking of algorithms-
- **Prof. Bernhard Sendhoff** (Honda Research Institute, D), **Prof. Fabian Duddeck** (TU München, D), **Prof. Markus Zimmermann**, (TU München, D): Real-world optimization problems in industry.
- **Prof. Holger Hoos** (Leiden Univ., NL): Machine learning, algorithm selection and configuration.

INTERNATIONAL ACTIVITIES

Research in collaboration with various industrial research environments, such as AirFrance KLM, BMW, Daimler, Honda, Tata Steel, Volkswagen, and many others. Topics: modeling, simulation, optimization, machine learning.