Computer Science Seminar

Evolutionary Strategies for Industrial Applications: Algorithms and Examples

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Evolutionary Strategies are a branch of evolutionary algorithms that have been originally developed for applications in continuous and mixed-integer domains. Like Genetic Algorithms, they belong to the research field of evolutionary computation, which has wide applications in machine learning, search, and optimization.

In this presentation, we will discuss these algorithms from the perspective of industrial applications. Some basic ideas of evolutionary strategies, including e.g. the mutation operator, the concept of self-adaptation for learning the hyperparameters on-line, and covariance matrix adaptation are briefly introduced.

From an application perspective, we will pick a sample problem from the automotive industry such as (passive) car body safety optimization to illustrate the capabilities of evolutionary strategies. Based on specific requirements of such industrial applications, we will show how well evolutionary strategies are able to deal with such requirements.

Bio: Thomas Bäck is full professor of computer science at the Leiden Institute of Advanced Computer Science (LIACS), Leiden University, The Netherlands, where he is head of the Natural Computing, Optimization and Industry 4.0 group since 2002.

He received his PhD in computer science from Dortmund University, Germany, in 1994, and then worked for the Informatik Centrum Dortmund (ICD) as department leader of the Center for Applied Systems Analysis. From 2000 - 2009, Thomas was CEO of NuTech Solutions GmbH and CTO of NuTech Solutions, Inc. He has ample experience in real-life applications of optimization and predictive analytics through working with global enterprises such as BMW, Beiersdorf, Daimler, Ford, Honda, and many others.

Thomas Bäck has more than 350 publications in predictive analytics, optimization, and industrial applications, as well as two books on evolutionary algorithms: Evolutionary Algorithms in Theory and Practice (1996), and Contemporary Evolution Strategies (2013). He is co-editor of the Handbook of Evolutionary Computation, and most recently, the Handbook of Natural Computing. He is also editorial board member and associate editor of a number of journals on evolutionary and natural computing. Thomas received the best dissertation award from the German Society of Computer Science (Gesellschaft für Informatik, GI) in 1995, the IEEE CIS Evolutionary Computation Pioneer Award in 2015, and he is an elected fellow of the International Society for Genetic and Evolutionary Computation for his contributions to the field.

A list of publications is available on Google Scholar: https://scholar.google.de/citations?hl=de&user=x7LEID0AAAAJ&pagesize=80

Date: August 21, 2017

Time: 10:00 am

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