Tutorial Proposal to IEEE CEC 2023

1 Extended Abstract

Title: Decomposition Multi-Objective Optimization: Current Developments and Future Opportunities

Instructor: Dr. Ke Li, Department of Computer Science, University of Exeter, UK.

Short introduction to the topic: Evolutionary multi-objective optimization (EMO) has been a major research topic in the field of evolutionary computation for many years. It has been generally accepted that combination of evolutionary algorithms and traditional optimization methods should be a next generation multi-objective optimization solver. As the name suggests, the basic idea of the decomposition-based technique is to transform the original complex problem into simplified subproblem(s) so as to facilitate the optimization. Decomposition methods have been well used and studied in traditional multi-objective optimization. MOEA/D decomposes a multi-objective problem into a number of subtasks, and then solves them in a collaborative manner. MOEA/D provides a very natural bridge between multi-objective evolutionary algorithms and traditional decomposition methods. It has been a commonly used evolutionary algorithmic framework in recent years.

An outline of the tutorial: Within this tutorial, a comprehensive introduction to MOEA/D will be given and selected research results will be presented in more detail. More specifically, we are going to (i) introduce the basic principles of MOEA/D in comparison with other two state-of-the-art EMO frameworks, i.e., Pareto- and indicator-based frameworks; (ii) present a general overview of state-of-the-art MOEA/D variants and their applications; (iii) discuss the future opportunities for possible further developments.

Learning outcomes: The intended audience of this tutorial can be both novices and people familiar with EMO or MOEA/D. In particular, it is self-contained that foundations of multi-objective optimization and the basic working principles of EMO algorithms will be included for those without experience in EMO to learn. Open questions will be posed and highlighted for discussion at the latter session of this tutorial.

Expected length of the tutorial: This tutorial is expected to be less than 2 hours including the discussion session.

The level of the tutorial: This tutorial is advanced level but with a gender introduction at the outset.

2 Short Bio of the Instructor

Ke Li is a Senior Lecturer (Associate Professor) in Computer Science at the Department of Computer Science, University of Exeter (UoE). His current research interests include the evolutionary multi-objective optimization, machine learning and applications in science and engineering. He is the founding chair of IEEE CIS Task Force on Decomposition-based Techniques in Evolutionary Computation. He currently serves as an associate editor of IEEE Transactions on Evolutionary Computation, International Journal of Machine Learning and Cybernetics and Complex & Intelligent Systems. He served as a guest editor in Neurocomputing Journal and Multimedia Tools and Applications Journal. He has been awarded a prestigious UKRI Future Leaders Fellow (FLF) and a Turing Fellow with the Alan Turing Institute. Since 2020, he has been recognized as being in the Stanford list of top 2% of scientists in the world (ranked as #2625 in the AI field). In 2021, he was awarded an Amazon Research Award for which I am 1 of only 3 winners in the UK (media covers are in module 4), and he was selected in the finalist of a Facebook Research Award. In 2020, he was awarded Research Excellence Award of the CEMPS Academic Recognition Awards 2020 and Teaching Awards 2020 as Outstanding Supervisor. Only one STEM faculty can be selected for these two awards at the UoE.