



# COLLEGE of ENGINEERING AND PHYSICAL SCIENCES

SCHOOL OF COMPUTER SCIENCE

## MSc Defence

Wednesday December 11, 2019 at 9AM in Reynolds, Room 1101

### A Dual Center Approach to CMA-ES

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#### Abstract

Covariance Matrix Adaptation – Evolution Strategies (CMA-ES) is a renowned state-of-the-art black-box optimization algorithm in the field of Evolutionary Computation. As real-world optimization problems began to be characterized as multimodal, CMA-ES was subject to modifications to improve its performance on these problems. The rise of multimodal problems presented a new challenge for optimization algorithms which is avoiding local optima while trying to find the global optimum.

The CMA-ES algorithm, although powerful, is not guaranteed to beat this challenge as it may be sampling in an area which contains basins of attraction where the global optimum does not reside. This could be attributed to the fact that CMA-ES uses a single-model Estimation Distribution Algorithm (EDA) to determine a single point in the problem landscape from which to perform sampling.

This research investigates the performance of CMA-ES on several multimodal and unimodal problems using two differently modeled EDAs with an overlapping model to perform sampling within the problem landscape. This proposed system, Dualcenter-CMA-ES (DC-CMA-ES) outperforms IPOP-CMA-ES on complex multimodal functions, especially as problem dimensionality increases.