Title: Analysis of State-of-the-art Nature-Inspired Metaheuristic Algorithms: Towards A Unified Perspective

Team: MISTIS team, INRIA Grenoble Rhone-Alpes
Advisors: Kai Qin and Florence Forbes
Localization: INRIA Grenoble Rhone-Alpes
Contact: florence.forbes@inrialpes.fr, tel: +33 4 76 61 52 50

Keywords: optimization, metaheuristic algorithm, nature-inspired computing, inferential statistics

Context
Many scientific and engineering issues can be formulated as optimization problems. Metaheuristic algorithms, as a general-purpose optimization technique, have demonstrated strong efficacy for solving complex optimization problems. Such algorithms iteratively evolve candidate solutions towards the optima with regard to the given measures of solution quality while making few or no assumptions about the problem being optimized. Nature-inspired metaheuristic algorithms are characterized by algorithmic operators mimicking computationally useful aspects of various natural phenomena. For example, genetic algorithm features crossover, mutation and selection operators simulating the biological evolution process. In fact, conceptually different operators, inspired by distinct natural phenomena, may behave similarly in optimization, while algorithmic performances intrinsically relate to the functional characteristics of operators. Therefore, comparing nature-inspired metaheuristic algorithms according to the functions of their involved operators in optimization towards a unified perspective can help systematically understanding state-of-the-art algorithms and guide the development of more effective algorithms.

Objectives
The goals of this internship are:
- To survey and analyze state-of-the-art natural-inspired metaheuristic algorithms in terms of the functions of their involved operators in optimization.
- To categorize operators as per their functions in optimization towards a unified perspective.
- To compare functionally similar operators in the context of specific state-of-the-art algorithms using inferential statistics.
- To develop novel algorithms by hybridizing superior operators within each function category.

Skills
The candidate is expected to have good background in computer science and statistics. The preferred knowledge or experience includes: metaheuristic optimization, natural-inspired computing and inferential statistics. The applicant should have good English reading, writing and oral communication skills. As regards to software development, C/C++ and Matlab languages are preferred.

References: