

AILSII+

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AILS-II in C – Overview

AILS-II (Adaptive Iterated Local Search II) is a metaheuristic widely used for solving vehicle routing problems, particularly variants of the Capacitated Vehicle Routing Problem (CVRP) and extensions such as time windows. In this work, we employ a version of AILS-II that has been completely rewritten in the C programming language, with a strong focus on computational performance, explicit memory control, and suitability for large-scale experimental studies.

The reimplementaion in C preserves the core logic of the original AILS-II, which is based on iterative cycles of local search, perturbation, and solution acceptance. At each iteration, the current solution is intensified using local search operators, followed by a diversification phase designed to escape local optima. The adaptive mechanism of the algorithm dynamically adjusts the search behavior during execution, seeking a balance between exploration and intensification.

Parameter Configuration via Command Line

A key feature of our C implementation of AILS-II is the ability to modify all major algorithm parameters directly via the command line. This design choice significantly enhances experimental flexibility, allowing multiple configurations to be tested without the need to recompile the source code.

Examples of parameters that can be configured through command-line arguments include stopping criteria, perturbation intensities, iteration limits, and weights associated with local search operators.

This approach facilitates systematic sensitivity analyses, parameter calibration, and seamless integration with automated experimentation scripts and high-performance computing environments.

As a result, the AILS-II algorithm rewritten in C not only maintains the solution quality of the original version, but also provides improved efficiency, greater experimental

control, and enhanced reproducibility, making it particularly suitable for academic research and large scale optimization studies.

Hardware used

When the competition began, each of us used our own MacBook Air with an Apple M4 processor. However, we soon realized that more powerful computing resources would be required. Therefore, we started using the University of São Paulo (USP) cluster called Euler, whose computing power is described as follows:

104 IP113 nodes, each with:

- 2 Intel Xeon E5-2680 v2 processors, 2.8 GHz, with 10 cores each
- 128 GB DDR3 1866 MHz RAM

Amount of computing time employed during the competition runs

During the first 10 days, all experiments were performed on our own computers. After that, the experiments were performed using Euler's infrastructure, where most of our BKS were achieved and where most of our computing time was spent.

In each experiment on Euler, all instances were tested as individual jobs. The experiments explored different features such as:

Different parameter configurations

Different time-limit criteria

All experiments were executed until the challenge deadline. In other words, when a simulation finished within an experiment, it restarted repeatedly until the deadline was reached. This allowed us to perform long-term simulations and to explore more candidate solutions in each restart.

The longest run lasted about 15 days without restarting. The average duration of each experiment was about 8 hours.

The total number of experiments was approximately 20.