NATCOR 2024 challenges

Introduction

We offer four practical challenges, each designed to provide you with a hands-on learning experience. You have the flexibility to choose one or more challenges to tackle based on the interests and goals of your group.

1. **Exact Optimisation Algorithms and MIP:**

   - Participants will focus on exact optimisation techniques and Mixed Integer Programming (MIP) algorithms.
   - Problem domain: TSP.

2. **Heuristics and Meta-heuristics:**

   - Participants will explore heuristic and meta-heuristic approaches for optimisation.
   - Problem domain: TSP.

3. **Automated Configuration (irace) and Selection Hyper-heuristics (HyFlex):**

   - Participants will utilise automated configuration techniques with irace and implement selection hyper-heuristics using HyFlex framework.
   - Problem domain: TSP.

4. **Big Data + Machine Learning for Energy Prediction (Regression):**

   - Participants will work on a machine learning regression problem focused on energy prediction using big data and machine learning techniques.
   - Problem domain: Regression modelling.

Track-based Evaluation

The evaluations are organised into tracks, with points assigned accordingly. (relevant to the marks of your course)

1. **Optimisation Challenges Track:**

   - Participants for solving practical challenges 1, 2, and 3 must submit TSP solutions on a specific TSP instance (when do we announce this instance?)
   - Assign points based on the performance of submitted solution:

Challenge 3: Automated Configuration (irace) and Selection Hyper-heuristics (HyFlex)

Relevant lectures:

- Hyper-heuristics (Ender Ozcan, Wednesday)

- Automated Configuration of Optimisation Algorithms (Manuel Lopez-Ibañez, Wednesday)

- Automated Algorithm Design (Rong Qu, Thursday)

Resources is available here TOADD. **"Resources-hyflex-irace-challenge" folder**

Brief description You are provided with several example hyper-heuristics with **HyFlex** and example usage of **irace** for automatic configuration. This challenge focuses on enhancing the performance of these hyper-heuristics through automatic algorithm configuration and other techniques.

Detailed description

In this challenge, you will work with example hyper-heuristic algorithms implemented with **HyFlex**. These hyper-heuristics operate on low-level heuristics that have parameters 'depthOfSearch' (DoS) and 'intensityOfSearch' (IoM).

You are provided with

- A set of example hyper-heuristics with **HyFlex**. The provided examples are tailored for solving TSP.

- Example configuration scenario settings for automatic configuration of one example hyper-heuristics with **irace**.

- Instructions (including a tutorial on Wednesday) for implementing the given examples.

Your task is to enhance the performance of these hyper-heuristics using various techniques to obtain better solutions for the selected TSP instances.

There might be many ways to improve the results we obtained here. A few ideas for you to think about:

- Automatic configuration for provided hyper-heuristics.

- Implement new high-level strategies.