Team Introduction: GDUT-CIS

Affiliation: School of Mathematics and Statistics, Guangdong University of Technology
Core Research Area: Automated Heuristic Design (AHD), Evolutionary Computation, Combinatorial Optimization
Team Members: Kezhao Lai, Yutao Lai **Advisor:** Prof. Hailin Liu

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1. Team Overview

The **GDUT-CIS** team originates from the **Computational Intelligence Team** at Guangdong University of Technology. Rooted in a strong mathematical foundation, our team specializes in bridging the gap between classical Evolutionary Computation (EC) and modern Large Language Models (LLMs). We focus on solving complex NP-hard problems, such as the Capacitated Vehicle Routing Problem (CVRP) and Traveling Salesman Problem (TSP), by designing interpretable and high-performance heuristic algorithms automatically.

2. Our "Secret Weapon": The Clade-AHD Framework

For this competition, we deploy our state-of-the-art framework: **Clade-AHD (Beyond the Node: Clade-level Selection for Efficient MCTS)**.

Traditional Monte Carlo Tree Search (MCTS) methods often suffer from over-exploitation when applied to code generation due to sparse evaluations. To overcome this, our approach introduces a paradigm shift **from "Node-level" estimation to "Clade-level" Bayesian beliefs**:

- **Clade-level Bayesian Inference:** Instead of relying on noisy point estimates of single code snippets, we model the potential of an entire evolutionary branch (a "Clade") using **Beta Distributions**. This allows us to capture the structural potential of algorithms under uncertainty.
- **Uncertainty-Guided Exploration:** We implement **Clade-level Thompson Sampling** to dynamically balance exploration and exploitation. This mechanism prioritizes branches with high uncertainty in the early stages and converges to high-performing solutions as the budget depletes.
- **Depth-Attenuated Credit Assignment:** Addressing the issue of semantic drift in code evolution, we utilize a depth-attenuated mechanism to propagate evaluation signals, ensuring robust credit assignment across long evolutionary paths.
- **Efficiency:** Our framework demonstrates superior sample efficiency, consistently outperforming SOTA methods like FunSearch and EoH on CVRP benchmarks while requiring significantly less computational cost.

3. Institutional Background & Achievements

Our team is backed by the prestigious **Computational Intelligence Team** led by **Prof. Hailin Liu** (IEEE Senior Member, Stanford Top 2% Scientist).

- **Track Record:** The lab has a history of excellence in algorithmic competitions, having won **1st Place** in the algorithm competitions at **IEEE WCCI 2018 and WCCI 2020** (World Congress on Computational Intelligence).
- **Academic Excellence:** The team has published over **200 papers** in top-tier journals such as *IEEE Transactions on Evolutionary Computation (TEVC)* and *IEEE*

Transactions on Cybernetics.

- **Research Depth:** With support from multiple National Natural Science Foundations, the lab possesses deep expertise in Evolutionary Multiobjective Optimization (EMO), High-cost Optimization, and Neural Architecture Search (NAS).

GDUT-CIS combines this deep theoretical heritage with cutting-edge LLM reasoning capabilities to push the boundaries of what automated solvers can achieve in combinatorial optimization.