# Yuxuan Ma

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## Education

**Southern University of Science and Technology** Sep 2022 – Jun 2026
Department of Computer Science and Engineering B.Eng. in Computer Science and Technology
GPA: 3.88/4.0 IELTS: 7.5 Turing Class (Honors Program)

**Technical University of Denmark** Feb 2025 – Jul 2025
Department of Applied Mathematics and Computer Science Research Intern
Adviser: Prof. Carsten Witt

## Research Interests:

ML, Optimization, Heuristics, Computational Intelligence, AutoML, Neuroevolution

## Publications

### Conference

**[GECCO'25]** Yuxuan Ma, Pietro S. Oliveto, John Alasdair Warwicker, "Random Gradient Hyper-heuristics Can Learn to Escape Local Optima in Multimodal Optimisation", In Proceedings of the Genetic and Evolutionary Computation Conference, ACM, 13 July 2025. **[Paper]**

### Manuscripts

Yuxuan Ma, Pietro S. Oliveto, John Alasdair Warwicker, "On the Effectiveness of Random Gradient Hyper-heuristics for Multimodal Optimisation", *Artificial Intelligence*, submitted, 8 July 2025.

Yuxuan Ma, Valentino Santucci, Carsten Witt. "Theoretical and Empirical Analysis of Lehmer Codes to Search Permutation Spaces with Evolutionary Algorithms". Under double-blind review at a major AI conference.

## Research Experience

**Theory of AI Lab** Jun 2024 – Present
Undergraduate Researcher Southern University of Science and Technology

Advised by Prof. Pietro S. Oliveto

- Analyzed the expected optimization time of **Selection Hyper-Heuristics** (SHHs) on the theoretical benchmark function TwoRates.
- Proposed and proved all main theorems, conducted all experiments, and wrote core technical sections.
- Provided the **first runtime analysis** that considers super-constant low-level heuristic set sizes, up to the complete set of $n$ different neighborhood sizes for RLS$_k$.
- **Improved** the previous best-known bound (Krejca & Witt, 2024) from $\mathcal{O}\left(n^{4.5}\right)$ to $\mathcal{O}\left(n^{\log_2 18+\varepsilon}\log n\right)$.
- Accepted at ***GECCO 2025*** (Theory track).
- Extended version submitted to ***Artificial Intelligence*** (journal).

**Algorithms, Logic and Graphs (AlgoLoG) Section** Feb 2025 – Jul 2025
Research Intern Technical University of Denmark

Advised by Prof. Carsten Witt

- Proposed RLS and $(1+1)$-EA for permutations using the **Lehmer code** representation. Analyzed their expected optimization time via variable and multiplicative drift theorems.
- Designed the algorithms, formulated and proved all main theorems, conducted all experiments, and wrote the theory sections.
- **Tightened** the prior best-known bounds (Doerr & Pohl, 2012) from $\mathcal{O}\left(n^4\log\log n\right)$ and $\Omega\left(n^2\log n\right)$ to $\Theta\left(n^2\log n\right)$ using a refined potential function for drift analysis.

- **Introduced** the unequal-probability coupon collector model into the runtime analysis of evolutionary computation and obtained a bound that is tight up to the leading constant.
- Manuscript under double-blind review at a major AI conference.

## Projects

**Google Summer of Code 2024** Feb 2024 – Aug 2024

**[Project link]** GSoC 2024 @ OpenCV (3-person team): Added multi-frame GIF support to `cv::imencode()` and `cv::imdecode()`, removing reliance on external tools for animated GIFs. Led testing and built GoogleTest-based C++ unit test suites. Merged into OpenCV 4.11.0 (PR #25691).

## Teaching Assistant

**Data Structures and Algorithm Analysis (Honors)** Sep 2024 – Jan 2025

Instructor: Prof. Pietro S. Oliveto

Graded weekly lab assignments and the final exam; maintained the course gradebook; answered student questions.

## Skills

**Programming:** C/C++, Java, Python, Mathematica, LaTeX

**Tools:** Git, Bash, Vim, Linux

## Personal Interests and Hobbies

Table Tennis, Harmonica, Travel