Yun Chen TSAI

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SUMMARY

I am a Year 4 undergraduate student at HKUST, majoring in Applied Mathematics. Experienced in academic research and finished various research projects under the supervision of Professor Shing Yu LEUNG, Amir GOHARSHADY, and Jean-François RASKIN. Those research projects focus on different aspects like scientific computation, algorithm design, formal methods, and complexity theory. My research interest mainly falls in the large area of formal methods, automata theory, and complexity theory, with the combination of a wide range of mathematical tools including but not limited to differential equations, optimization techniques, probability theory, algebraic method, to develop efficient algorithms and construct proofs for correctness, convergence and hardness result in the above field.

EDUCATION

Hong Kong University of Science and Technology (HKUST)
BSc in Mathematics   *Graduation: January 2024*

PUBLICATION

- G. K. Conrado, A. K. Goharshady, K. Kochekov, Y. C. Tsai, A. K. Zaher (2023). *Exploiting the Sparseness of Control-flow and Call Graphs for Efficient and On-demand Algebraic Program Analysis.* ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications, OOPSLA 2023.
- Y. C. Tsai, S. Y. Leung (2023). *Local Trajectory Variation Exponent (LTVE) for Visualizing Dynamical Systems.* Submitted to Communication in Computational Physics, CiCP.

RESEARCH PROJECT

Project title	Supervisor

Efficient algorithm on Visualizing Dynamical Surface   Dr. Shing Yu LEUNG

- In this project, we aim to develop efficient methods for visualizing the Lagrangian Coherent Structure under different settings, with a particular focus on the Lagrangian coherent structure. Various approaches like Finite-time Lyapunov Exponent, clustering methods, and trajectory analysis have been studied. In addition, we also look into the stochastic setting and study the extension of previous approaches.

Parameterized Algorithms in Static Program Analysis   Dr. Amir GOHARSHADY

- This project is focusing on improving the existing algorithm for static program analysis through parameterization. The major motivation behind this is that many of the problems in the field are proven to be at least NP-hard in general, but the practical use case might exhibit special structures or carry small parameters. We look into problems like Algebraic program analysis and probabilistic model checking to look for potentially useful parameterization for the problems.

Automata Learning and Program Synthesis   Dr. Jean-François RASKIN

- This project aims to study the use of automata learning to program synthesis problems. In particular, we looked into the problems of example-guided synthesis, we focus on the case when a stochastic environment input is involved and attempt to formulate a way to generate a set of optimal realizable examples of system trace with respect to a certain cost/reward function.

Scholarship

- Chern Class Talent Scholarship
- HKSAR Government Scholarship Fund - Reaching Out Award