Gerald Huang

Theoretical Computer Science

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– Research Interests –

My principal research interest is in **algorithms** (approximation, exact, lower bounds, online, parameterised, quantum) and **computational complexity theory** (circuit complexity and quantum complexity). I also occasionally dabble in **combinatorics** (algebraic, enumerative, extremal), **combinatorial optimisation**, **logic and verification**, **number theory**.

– Education –

2024 – 2028 **University of Melbourne**, Melbourne, Victoria, Australia.
Doctor of Philosophy (PhD) in Computer Science; specialises in **algorithm and complexity theory**.

- **Supervisors**: Dr. Seeun William Umboh and Dr. Junhao Gan.
- **Awards and Honours**: Australian Government Research Training Program Scholarship.

2018 – 2024 **University of New South Wales**, Sydney, New South Wales, Australia.
Bachelor of Science in Computer Science with Honours, Bachelor of Science in Mathematics (Pure Mathematics); specialised in **theory**.

- Distinction in Mathematics, Honours Class I in Computer Science Honours.
- **Thesis**: *Quantum Algorithms for the Steiner Tree Problem* [paper] | [poster].
- **Supervisor**: Prof. Serge Gaspers.
- **Awards and Honours**: UNSW Taste of Research Scholar, 2022 – 2023.
- Presented at the 2023 UNSW Thesis Showcase.

– Employment –

Feb, 2024 **Lecturer**, *University of New South Wales*.

- **Course**: COMP3821/9801 – Extended Algorithm Design and Analysis.

Dec, 2023 – May, 2024	**Research Assistant**, *University of New South Wales*. • **Advisor**: Prof. Ron Van der Meyden. • **Project**: *Fault Tolerant Autonomy*.
Nov, 2023	**Guest Lecturer**, *University of New South Wales*. • **COMP3121/9101**: Algorithm Design and Analysis – Introduction to Dynamic Programming and its Applications to Games.
Sep – Dec, 2023	**Course Administrator**, *University of New South Wales*. • **COMP4418**: *Knowledge Representation and Reasoning*.
Feb, 2023 – current	**Teaching Assistant**, *University of Sydney* • See [teaching].
Feb, 2021 – Feb, 2024	**Teaching Assistant**, *University of New South Wales* • See [teaching].

– Publications –

Research

Each *published* paper can be accessed via the link if viewing on a desktop; they can also be accessed via my website.

[1] Model Checking and Synthesis for Optimal Use of Knowledge in Simultaneous Agreement Protocols. With Kaya Alpturer, Ron van der Meyden. 2024.

[2] Quantum Algorithms for the Steiner Tree Problem. With Serge Gaspers. 2023.

[3] Implementation and Analysis of Quantified Boolean Formula Encodings for Planning and Verification Problems. With Abdallah Saffidine. 2022 – 2023.

[4] Notes on the Union-Closed Sets Conjecture. With Thomas Britz. 2022.

Books

Books that I have either released or are in the process of being released. Chapter preprints are available on my website.

[1] *An Invitation to Algorithm Design and Analysis*. 1st edition.

[2] *An Invitation to Combinatorics*. 1st edition, Springer Undergraduate Texts in Mathematics and Technology, 2024.

[3] *ATAR Notes HSC Year 12 Mathematics Extension 1 Complete Course Notes*. 1st edition, ATARNotes, 2020.

[4] *ATAR Notes HSC Year 12 Mathematics Extension 1 Topic Tests*. 1st edition, ATARNotes, 2020.

Notes and Articles

You can find a more complete set of notes and articles that I've written on my website.

[1] *Derandomisation and the Nisan-Wigderson Construction*, September 2023.

[2] *The Sunflower Lemma and its Modification*, September 2023.

– Teaching –

Instruction

Number of students are shown and the overall evaluation of the instructor quality received from the cohort.

Term	Course number and title	Students	Rating
Term 1, 2024	**COMP9801**: Extended Algorithm Design and Analysis	95	4.82 / 6.0
Term 1, 2024	**COMP3821**: Extended Algorithm Design and Analysis	13	4.82 / 6.0

The rating (out of 6.0) comes from the students' evaluation of the instructor quality throughout the course. Undergraduate teaching is done through tutorials. Teaching is separated by university.

University of New South Wales

Course number	Course title	Year(s)	Avg. Rating
COMP2521	Data Structures and Algorithms	2023	5.34 / 6.0
COMP3121/9101	Algorithm Design and Analysis	2021 – 2024	5.29 / 6.0
COMP3153/9153	Algorithmic Verification	2022, 2023	5.44 / 6.0
COMP3821/9801	Extended Algorithm Design and Analysis	2021 – 2024	5.48 / 6.0
COMP3900/9900	Computer Science Project	2022, 2023	5.67 / 6.0
COMP4141	Theory of Computation	2023, 2024	5.63 / 6.0
COMP4418	Knowledge Representation and Reasoning	2022, 2023	N/A
COMP9020	Foundations of Computer Science	2024	N/A
MATH1041	Statistics for Life and Social Sciences	2023	N/A

University of Sydney

Course number	Course title	Year(s)	Avg. Rating
COMP2022	Models of Computation	2023, 2024	N/A
COMP2922	Advanced Models of Computation	2023, 2024	N/A
COMP3027	Algorithm Design	2023	N/A
COMP3927	Advanced Algorithm Design	2023	N/A

COMP4270/5270	Randomised and Advanced Algorithms	2024	N/A

– Talks and Lectures –

Student Talks

Student talks that come from societies are marked with *, whilst student talks that come from conferences are marked with ○.

[1] *Expander Graphs**, Advanced Topics in Theoretical Computer Science, May 2024.

[2] *On the Transcendence of e**, UNSW Mathematics Society, June 2023.

[3] *When Combinatorics and Flow Networks Intersect**, UNSW Computer Science and Engineering Society, UNSW Competitive Mathematics and Programming Society, March 2023.

– Extra-curricular Activities –

Leadership and Societies

I have been involved in multiple leadership positions in faculty-focused societies.

[1] *UNSW Mathematics Society*: Education Subcommittee (2019, 2022, 2023), Director of Education (2020), Society Executive (2021).

[2] *UNSW Computer Science and Engineering Society*: Education Subcommittee (2023).

[3] *UNSW Competitive Programming and Mathematics Society*: Competitions Subcommittee (2024).

Reading Group

I am also actively involved in a reading group for *Advanced Topics in Theoretical Computer Science* run by the Faculty of Computer Science and Engineering.