HUNG GUEI (桂泓)

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EDUCATIONAL BACKGROUND

2016/09 – 2023/01 **Ph.D.**, Institute of Computer Science and Engineering,
National Yang Ming Chiao Tung University, Hsinchu, Taiwan
Direct Admission into Ph.D. (M.S. Program: 2015/02 – 2016/08)
Advisor: Prof. I-Chen Wu

2011/09 – 2015/01 **B.S.**, Department of Computer Science and Information Engineering,
National Central University, Taoyuan, Taiwan

WORK EXPERIENCE

2026/08 – **Assistant Professor**, Institute of Intelligent Systems, College of Artificial Intelligence,
National Yang Ming Chiao Tung University, Tainan, Taiwan

2023/03 – 2026/07 **Postdoctoral Scholar**, Institute of Information Science,
Academia Sinica, Taipei, Taiwan
Taiwan's Auxiliary Service Corps for R&D (研發替代役)

2022/08 – 2023/02 **Research Assistant**, Institute of Information Science,
Academia Sinica, Taipei, Taiwan

RESEARCH INTERESTS

- **Zero-Knowledge Reinforcement Learning**

  AlphaZero, MuZero, Gumbel MuZero, Stochastic MuZero, and related methods
- **Reinforcement Learning**
- **Tree-Based Planning**
- **Computer Games**

RESEARCH OVERVIEW

Zero-Knowledge Reinforcement Learning

- Developed *MiniZero*, a general framework for AlphaZero, MuZero, Gumbel AlphaZero, Gumbel MuZero, and other zero-knowledge reinforcement learning methods. **Published in IEEE T-G [3] and open-sourced on GitHub [24] (received 100+ stars)**.
- Proposed *OptionZero*, which integrates options into MuZero with autonomous option discovery during training, achieved an average score of 131.58% on the Atari benchmark. **Accepted in ICLR 2025 [11] with an oral presentation (1.8% of 11,500 papers)**.
- Investigated the interpretability of MuZero and demonstrated that MuZero can maintain its planning performance by correcting the errors in the dynamics network. **Published in IEEE**

TAI [2] and TAAI 2024 [12] (Runner-Up Paper Award among 54 accepted papers).

- Developed an AlphaZero-based solving method with online fine-tuning. Experiments in 7×7 Killall-Go showed that the same tasks could be solved using 24% of the computational resources required by the baseline. **Related works published in NeurIPS 2023 [14], ACG 2025 [10], and IEEE T-G [1]**.
- Studied the strength adjustment method for Monte Carlo tree search. Achieved near-linear strength adjustment by dynamically adjusting the move selection during the search. **Published in IEEE CIM [6], AAAI-19 [17], and two patents [21] [22]**.

Reinforcement Learning in the Application of Computer Games

- Developed a 2048 game-playing program using RL methods, achieving an average score of 625,377 points and a 72% rate for reaching the 32768-tile [5]. **The program is published on GitHub [26] and is recognized as the state-of-the-art RL program for 2048, outperforming DeepMind's Stochastic MuZero algorithm.**
- Researched reinforcement learning methods for stochastic games and imperfect information games [5] [8] [9] [16] [20]: Proposed optimistic temporal difference learning, **published in IEEE T-G [5]**; combined Gumbel MuZero and Stochastic MuZero, **published in TAAI 2022 [16]**; improved AlphaZero in imperfect information games, **published in IEEE CoG 2026 [8]**.
- Built game-playing AI programs for 2048, Connect6, Gomoku, etc.; received awards include **Computer Olympiad 2024 (5 Gold and 1 Silver), Computer Olympiad 2016 (1 Gold)**.

Reinforcement Learning Course Design

- Designed beginner-friendly RL teaching materials using 2048 and Tic-tac-toe programs [25], **taught at National Taiwan University, National Yang Ming Chiao Tung University, and MediaTek, mentoring hundreds of students since 2017**.
- Delivered RL talks and held hands-on workshops using 2048, **including one talk at TIGP SHNCC in the Institute of Information Science of Academia Sinica, four seminars in the National University of Tainan, and two lectures in the IEEE CIS Summer School.**
- Documented teaching materials and experience **in ICGA Journal [7] and two international conferences [18] [19], and open-sourced teaching resources [27] [28]**.

HONORS AND AWARDS

Ph.D. Dissertation Awards

2023 **Best Ph.D. Dissertation Award (博士論文獎)**
Awarded by the Taiwanese Association for Artificial Intelligence (TAAI).

2023 **Best Ph.D. Dissertation Award (博士論文獎)**
Awarded by the IEEE Computational Intelligence Society Taipei Chapter (CIS-11).

2023 **Best Ph.D. Dissertation Award (博士論文獎)**
Awarded by the Taiwan Computer Game Association (TCGA).

2023 **Honorable Mention Ph.D. Dissertation Award (博士論文獎佳作)**
Awarded by the Institute of Information & Computing Machinery (IICM).

International Awards

2025 Computer Olympiad 2025, **3 Gold** (Connect6, Dots and Boxes, Outer-Open Gomoku) and **1 Silver** (Breakthrough).

2024 TAAI 2024 **Runner-Up Paper Award** (among 54 accepted papers).

2024 Computer Olympiad 2024, **5 Gold** (Connect6, Dots and Boxes, International Draughts, Outer-Open Gomoku, Santorini) and **1 Silver** (Breakthrough).

2023 Computer Olympiad 2023, **Gold** (EinStein Würfelt Nicht!).

2016 Computer Olympiad 2016, **Gold** (2048).

2015 Computer Olympiad 2015, **Silver** (2048).

2015 TAAI 2015 Computer Game Tournaments, **Silver** (2048).

Taiwan Domestic Awards

2026 Excellent Draftee, Taiwan's Auxiliary Service Corps for R&D (研發替代役績優役男).

2025 TCGA 2025 Computer Game Tournaments, **2 Gold** (Connect6, Dots and Boxes**)**.

2025 Foundation for the Advancement of Outstanding Scholarship (FAOS; 傑出人才基金會), Postdoctoral Travel Grant to ICLR 2025, Singapore.

2024 Academia Sinica, **Postdoctoral Scholar Appointment (中研院院聘博士後研究學者申請)**, acceptance rate: 43%.

2023 Foundation for the Advancement of Outstanding Scholarship (FAOS; 傑出人才基金會), Postdoctoral Travel Grant to NeurIPS 2023, New Orleans, US.

2015 TCGA 2015 Computer Game Tournaments, **Gold** (2048).

2014 MOEA DoIT, Get Fresh Competition (經濟部搶鮮大賽), System Integration Track, **Silver**.

2014 Collegiate Programming Examination (CPE; 大學程式能力檢定), solved 6 in 7 questions, **ranked 4/930 (top 0.4%)** among participants.

PROFESSIONAL SERVICES

Invited Talks and Workshops

2026/06/01 Seminar, Taiwan International Graduate Program, Academia Sinica, Taipei, Taiwan.
Title: *Planning with Zero-Knowledge Reinforcement Learning in Games.*

2026/05/04 Seminar, National Chung Cheng University, Chiayi, Taiwan.
Title: *Planning with Zero-Knowledge Reinforcement Learning in Games.*

2025/08/29 AI Premier Conference Paper Symposium, National Taiwan University, Taipei, Taiwan.
Title: *OptionZero: Planning with Learned Options.*

2025/07/05 IEEE Computational Intelligence Society (CIS) Summer School, Paris, France.
Title: *Lecture 2: Reinforcement Learning.*

2024/12/17 Seminar, National University of Tainan, Tainan, Taiwan.
Title: *Reinforcement Learning in Games: Temporal Difference Learning & AlphaZero.*

2024/06/28 IEEE Computational Intelligence Society (CIS) Summer School, Yokohama, Japan.

Title: *Hands-on Workshop: Reinforcement Learning & Game.*

2024/05/16 Seminar, National University of Tainan, Tainan, Taiwan.
Title: *Reinforcement Learning Tutorials: From Temporal Difference Learning to AlphaZero.*

2023/09/28 Seminar, National University of Tainan, Tainan, Taiwan.
Title: *On Reinforcement Learning for the Game of 2048.*

2023/05/18 Seminar, National University of Tainan, Tainan, Taiwan.
Title: *On Reinforcement Learning for the Game of 2048.*

Conference Organization and Program Committees

2026 Evaluation Committee, the 25th Macronix Science Awards, Taiwan

2025 Session Chair, the 16th Asian Conference on Machine Learning (ACML 2025)

2025 Workflow Chair, the 16th Asian Conference on Machine Learning (ACML 2025)

2025 Session Chair, Advances in Computer Games 2025 (ACG 2025)

2025 Session Chair, AI Premier Conference Paper Symposium

2024 Program Committee Member, the Computers and Games 2024 Conference (CG 2024)

2024 Program Committee Member, the 2024 International Computer Symposium (ICS 2024)

Peer Review for Journals and Conferences

2026 ACL ARR 2026 May

2026 **Scientific Reports**

2026 **International Conference on Machine Learning (ICML)**

2026 **Conference on Neural Information Processing Systems (NeurIPS)**

2026 IEEE Transactions on Games (IEEE T-G)

2025 **International Conference on Machine Learning (ICML)**

2025 ICGA Journal

2025 Machine Learning

2025 Acta Informatica

2025 IEEE Transactions on Games (IEEE T-G)

2024 **ACM Computing Surveys (CSUR)**

2024 **International Conference on Machine Learning (ICML)**

2024 **Conference on Neural Information Processing Systems (NeurIPS)**

2024 IEEE Transactions on Games (IEEE T-G)

2023 IEEE Transactions on Games (IEEE T-G)

2022 IEEE Transactions on Games (IEEE T-G)

2021 IEEE Transactions on Games (IEEE T-G)

2020 IEEE Transactions on Games (IEEE T-G)

2018 Journal of Information Processing Society of Japan (IPSJ Journal)

2017 IEEE Transactions on Computational Intelligence and AI in Games (IEEE T-CIAIG)

2016 IEEE Transactions on Computational Intelligence and AI in Games (IEEE T-CIAIG)

Participation in NSTC-Funded Research Projects

2025 – 2027 零知識強化學習技術及其應用於電腦遊戲之研究—子計畫二：基於零知識強化學習技術之精確證明問題研究 (協同研究人員)

2024 – 2025 零知識強化學習技術及其應用於電腦遊戲之研究—總計畫暨子計畫一：零知識強化學習技術軟體框架之研究設計

2022 – 2024 基於證明成本網路之通用電腦遊戲解題研究

2021 – 2025 普適 AI 服務：數位轉型趨勢下的智慧型代理人 (人工智慧 AI 專案計畫)

2021 – 2024 MuZero 軟體框架及其電腦遊戲之應用—總計畫暨子計畫一：MuZero 軟體框架之研究設計

2018 – 2021 深度強化式學習技術之應用研究 (AI 創新研究中心專案研究計畫)

2017 – 2019 雙層疊工作層級運算系統及其電腦遊戲之應用暨子計畫一：研究設計雙層疊工作層級運算系統

PUBLICATIONS

Journal Articles

[1] Chung-Chin Shih, Ti-Rong Wu, Ting Han Wei, Yu-Shan Hsu, **Hung Guei**, I-Chen Wu, "A Study of Solving Life-and-Death Problems in Go Using Relevance-Zone Based Solvers," *IEEE Transactions on Games*, in press, Dec. 2025.

[2] **Hung Guei**, Yan-Ru Ju, Wei-Yu Chen, Ti-Rong Wu, "Demystifying MuZero Planning: Interpreting the Learned Model," *IEEE Transactions on Artificial Intelligence*, vol. 7, no. 2, pp. 1025–1036, Feb. 2026.

[3] Ti-Rong Wu, **Hung Guei**, Pei-Chiun Peng, Po-Wei Huang, Ting Han Wei, Chung-Chin Shih, Yun-Jui Tsai, "MiniZero: Comparative Analysis of AlphaZero and MuZero on Go, Othello, and Atari Games," *IEEE Transactions on Games*, vol. 17, no. 1, pp. 125–137, Mar. 2025.

[4] Po-Ting Chen, Chien-Liang Kuo, De-Rong Sung, **Hung Guei**, I-Chen Wu, "MuMu Won the EinStein Würfelt Nicht! Tournament," *ICGA Journal*, vol. 45, no. 2–3, pp. 81–84, Jan. 2024.

[5] **Hung Guei**, Lung-Pin Chen, I-Chen Wu, "Optimistic Temporal Difference Learning for 2048," *IEEE Transactions on Games*, vol. 14, no. 3, pp. 478–487, Sep. 2022.

[6] An-Jen Liu, Ti-Rong Wu, I-Chen Wu, **Hung Guei**, Ting-Han Wei, "Strength Adjustment and Assessment for MCTS-Based Programs," *IEEE Computational Intelligence Magazine*, vol. 15, no. 3, pp. 60–73, Aug. 2020. **(Impact factor 11.356)**

[7] **Hung Guei**[*], Ting-Han Wei[*], I-Chen Wu, "2048-like Games for Teaching Reinforcement Learning," *ICGA Journal*, vol. 42, no. 1, pp. 14–37, May 2020. ([*] contributed equally)

Conference Papers

[8] Qian-Rong Li, Hung Guei, I-Chen Wu, Ti-Rong Wu, "MAPLE: Multi-State Aggregated Policy Evaluation for AlphaZero in Imperfect-Information Games," *IEEE Conference on Games (IEEE CoG 2026)*, Madrid, Spain, Sep. 2026.

[9] Chun-Jui Wang, Jian-Ting Guo, **Hung Guei**, Chung-Chin Shih, Ti-Rong Wu, I-Chen Wu, "Evaluating Game Difficulty in Tetris Block Puzzle," *The 30th Game Programming Workshop (GPW-25)*, Kanagawa, Japan, Nov. 2025.

[10] Chi-Huang Lin, Ting Han Wei, Chun-Jui Wang, **Hung Guei**, Chung-Chin Shih, Yun-Jui Tsai, I-Chen Wu, Ti-Rong Wu, "Relevance-Zone Reduction in Game Solving," *Advances in Computer Games 2025 (ACG 2025)*, online, Oct. 2025.

[11] Po-Wei Huang, Pei-Chiun Peng, **Hung Guei**, Ti-Rong Wu, "OptionZero: Planning with Learned Options," *The Thirteenth International Conference on Learning Representations (ICLR 2025)*, Singapore, Apr. 2025. **(Oral presentation: 1.8%, acceptance rate: 32.08% among 11,500 papers)**

[12] **Hung Guei**, Yan-Ru Ju, Wei-Yu Chen, Ti-Rong Wu, "Interpreting the Learned Model in MuZero Planning," *The 29th International Conference on Technologies and Applications of Artificial Intelligence (TAAI 2024)*, Hsinchu, Taiwan, Dec. 2024. **(Runner-up paper award among 54 accepted papers)**

[13] Yun-Jui Tsai, Ting Han Wei, Chi-Huang Lin, Chung-Chin Shih, **Hung Guei**, I-Chen Wu, Ti-Rong Wu, "Solving 7x7 Killall-Go with Seki Database," *The Computers and Games 2024 Conference (CG 2024)*, online, Nov. 2024.

[14] Ti-Rong Wu[*], **Hung Guei[*]**, Ting Han Wei, Chung-Chin Shih, Jui-Te Chin, I-Chen Wu, "Game Solving with Online Fine-Tuning," *The Thirty-Seventh Annual Conference on Neural Information Processing Systems (NeurIPS 2023)*, New Orleans, USA, Dec. 2023. **(Acceptance rate: 26.1% among 12,343 papers; [*] contributed equally)**

[15] Chien-Liang Kuo, Po-Ting Chen, **Hung Guei**, De-Rong Sung, Chu-Hsuan Hsueh, Ti-Rong Wu, I-Chen Wu, "An Empirical Analysis of Gumbel MuZero on Stochastic and Deterministic Einstein Würfelt Nicht!," *The 2023 Conference on Technologies and Applications of Artificial Intelligence (TAAI 2023)*, Yunlin, Taiwan, Dec. 2023.

[16] Chih-Yu Kao, **Hung Guei**, Ti-Rong Wu, I-Chen Wu, "Gumbel MuZero for the Game of 2048," *The 2022 Conference on Technologies and Applications of Artificial Intelligence (TAAI 2022)*, Tainan, Taiwan, Dec. 2022.

[17] I-Chen Wu, Ti-Rong Wu, An-Jen Liu, **Hung Guei**, Tinghan Wei, "On Strength Adjustment for MCTS-Based Programs," *The Thirty-Third AAAI Conference on Artificial Intelligence (AAAI-19)*, Hawaii, USA, Jan. 2019. **(Acceptance rate: 16.2% among 7,095 papers)**

[18] **Hung Guei**, Ting-Han Wei, I-Chen Wu, "Teaching Reinforcement Learning and Computer Games with 2048-Like Games," *The 33rd Annual Conference of the Japanese Society for Artificial Intelligence (JSAI 2019)*, Niigata, Japan, Jun. 2019.

[19] **Hung Guei**, Ting-Han Wei, I-Chen Wu, "Using 2048-like Games as a Pedagogical Tool for Reinforcement Learning," *The 10th International Conference on Computers and Games (CG2018)*, New Taipei, Taiwan, Jul. 2018.

[20] **Hung Guei**, Tinghan Wei, Jin-Bo Huang, I-Chen Wu, "An Empirical Study on Applying Deep Reinforcement Learning to the Game 2048," *The Workshop Neural Networks in Games in the*

9th International Conference on Computers and Games (CG2016), Leiden, the Netherlands, Jun. 2016.

Patents

[21] I-Chen Wu, Ti-Rong Wu, An-Jen Liu, **Hung Guei**, Ting-Han Wei, "Method for adjusting the strength of turn-based game automatically," *U.S. Patent*, US11247128B2, Feb. 2022.

[22] I-Chen Wu, Ti-Rong Wu, An-Jen Liu, **Hung Guei**, Ting-Han Wei, "Method for automatically modifying strength of turn based game," *R.O.C. Patent*, TWI725662B, Apr. 2021.

Dissertation

[23] **Hung Guei**, "On Reinforcement Learning for the Game of 2048," *Ph.D. Dissertation*, Institute of Computer Science and Engineering, National Yang Ming Chiao Tung University, Hsinchu, Taiwan, Jan. 2023. **(Three Best Ph.D. Thesis Awards and one Honorable Mention Award)**

Open-Source Software

[24] Ti-Rong Wu, **Hung Guei**, *et al.*, "MiniZero: An AlphaZero and MuZero Training Framework," *GitHub repository*, https://github.com/rlglab/minizero.

[25] Yu-Hung Chang*, **Hung Guei***, Ti-Rong Wu, "Tutorials for reinforcement learning in games," *GitHub repository*, https://github.com/rlglab/rlg-tutorial. (* contributed equally)

[26] **Hung Guei**, "TDL2048+: The Most Efficient Temporal Difference Learning Framework for 2048," *GitHub repository*, https://github.com/moporgic/TDL2048.

[27] **Hung Guei**, "TDL2048-Demo: Temporal Difference Learning for Game 2048 (Demo)," *GitHub repository*, https://github.com/moporgic/TDL2048-Demo.

[28] **Hung Guei**, "2048-Framework: Framework for 2048 & 2048-like Games (C++/Python)," *GitHub repository*, https://github.com/moporgic/2048-Framework; https://github.com/moporgic/2048-Framework-Python.

REFERENCES

- Prof. **I-Chen Wu** (icwu@cs.nycu.edu.tw) – Ph.D. Advisor
  Distinguished Professor and Associate Dean, College of Computer Science, National Yang Ming Chiao Tung University, Hsinchu, Taiwan.
  Joint Appointment Professor/Research Fellow, Research Center for Information Technology Innovation (CITI), Academia Sinica, Taipei, Taiwan.
  Visiting Professor, Kochi University of Technology, Kami, Japan.
  Vice President, International Computer Games Association (ICGA).
- Prof. **Ti-Rong Wu** (tirongwu@iis.sinica.edu.tw) – Postdoctoral Supervisor
  Assistant Research Fellow/Professor, Institute of Information Science, Academia Sinica, Taipei, Taiwan.