

# Hsin-Yuan Huang (Robert)

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## EDUCATION

### Ph.D., California Institute of Technology

Oct. 2018 - Now

*Advised by John Preskill (Physics) and Thomas Vidick (CS, Math).*

*Participated in “Quantum Machine Learning for High Energy Physics” led by Maria Spiropulu (Caltech), Seth Lloyd (MIT) and Daniel Lidar (USC).*

### B.S., National Taiwan University

Sep. 2014 - Jun. 2018

*Studied in Computer Science (major) and Physics (minor). GPA: 4.30/4.30, Rank: 1/120.*

*Member of the Machine Learning and Data Mining Group; Advisor: Chih-Jen Lin*

## RESEARCH EXPERIENCE

Research Assistant, Institute for Quantum Information and Matter, Caltech	Oct. 2018 - Now
Research Intern, Google AI Quantum, Mentor: Jarrod R. McClean	Jun. 2020 - Oct. 2020
Visitor, Centre for Quantum Technologies, Host: Patrick Rebentrost	Jul. 2019 - Aug. 2019
Research Intern, Allen Institute for Artificial Intelligence, Mentor: Wen-tau Yih	Jun. 2018 - Sep. 2018
Research Intern, Microsoft Research, Redmond, USA, Mentor: Chenguang Zhu	Jun. 2017 - Sep. 2017
Research Assistant, Dept. of Computer Science, NTU, PI: Chih-Jen Lin	Sep. 2014 - Jun. 2018
Research Assistant, Dept. of Life Science, NTU, PI: Hsueh-Fen Juan	May 2013 - Aug. 2014
Research Assistant, Institute of Earth Sciences, Academia Sinica, PI: Fong Chao	Mar. 2012 - Mar. 2013

## ACADEMIC PAPERS

- [1] **H.-Y. Huang**, R. Kueng, J. Preskill. Provable machine learning algorithms for quantum many-body problems. In preparation.
- [2] **H.-Y. Huang**, R. Kueng, J. Preskill. Efficient estimation of Pauli observables by derandomization. arXiv preprint, arxiv:2103.07510, 2021.
- [3] J. Cotler, D. Mark, **H.-Y. Huang (Co-first author)**, F. Hernandez, J. Choi, A. L. Shaw, M. Endres, S. Choi. Emergent quantum state designs from individual many-body wavefunctions. arXiv preprint, arxiv:2103.03536, 2021.
- [4] J. Choi, A. Shaw, I. Madjarov, X. Xie, J. Covey, J. Cotler, D. Mark, **H.-Y. Huang**, A. Kale, H. Pichler, F. Brandao, S. Choi, M. Endres. Emergent Randomness and Benchmarking from Many-Body Quantum Chaos. arXiv preprint, arxiv:2103.03535, 2021.
- [5] **H.-Y. Huang**, R. Kueng, J. Preskill. Information-theoretic bounds on quantum advantage in machine learning. arXiv preprint, arxiv:2101.02464, 2021. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021 (Talk title: Fundamental aspects of solving quantum problems with machine learning).
- [6] Y. Su, **H.-Y. Huang**, E. Campbell. Nearly-tight Trotterization of interacting electrons. arXiv preprint, arxiv:2012.09194, 2020. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021.

- [7] **H.-Y. Huang**, M. Broughton, M. Mohseni, R. Babbush, S. Boixo, H. Neven, J. R. McClean. Power of data in quantum machine learning. arXiv preprint, arxiv:2011.01938, 2020. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021 (Talk title: Fundamental aspects of solving quantum problems with machine learning).
- [8] C.-F. Chen, **H.-Y. Huang (Co-first author)**, R. Kueng, J. Tropp. Quantum simulation via randomized product formulas: Low gate complexity with accuracy guarantees. arXiv preprint, arxiv:2008.11751, 2020.
- [9] A. Elben, R. Kueng, **H.-Y. Huang**, R. van Bijnen, C. Kokail, M. Dalmonte, P. Calabrese, B. Kraus, J. Preskill, P. Zoller, B. Vermersch. Mixed-state entanglement from local randomized measurements. *Physical Review Letter*, 2020.
- [10] **H.-Y. Huang**, R. Kueng, J. Preskill. Predicting many properties in a quantum system from very few measurements. *Nature Physics*, 2020.
- [11] **H.-Y. Huang**, K. Bharti, P. Rebentrost. Near-term quantum algorithms for linear systems of equations. arXiv preprint, arxiv:1909.07344, 2019.
- [12] **H.-Y. Huang**, R. Kueng. Predicting features of quantum systems using classical shadows. In *23rd Annual Conference on Quantum Information Processing (QIP-20)*, 2020. (single-track talk)
- [13] **H.-Y. Huang**, E. Choi, W. Yih. FlowQA: grasping flow in history for conversational machine comprehension. In *7th International Conference on Learning Representations (ICLR-19)*, 2019.
- [14] **H.-Y. Huang**, C. Zhu, Y. Shen, W. Chen. FusionNet: Fusing via Fully-aware attention with application to machine comprehension. In *6th International Conference on Learning Representations (ICLR-18)*, 2018. (top 3% in review score)
- [15] H.-F. Yu, **H.-Y. Huang**, I. S. Dhillon, C.-J. Lin. A unified algorithm for one-class structured matrix factorization with side information. In *31st AAAI Conference on Artificial Intelligence (AAAI-17)*, 2017. (acceptance rate: 24.6%)
- [16] **H.-Y. Huang**, C.-J. Lin. Linear and kernel classification: When to use which? In *SIAM International Conference on Data Mining (SDM-16)*, 2016. (acceptance rate: 25.8%)
- [17] C.-Y. Chen, A. Ho, **H.-Y. Huang**, H.-F. Juan and H.-C. Huang. Dissecting the human protein-protein interaction network via phylogenetic decomposition. In *Scientific Reports*, 4, 7153 (2014).

## SELECTED AWARDS AND HONORS

### Awards for Academic Excellence:

*First Place Scholarship, Ministry of Education (awarded to Olympiad medalists ranking top 1)*

2015, 2016, 2017, 2018

*Presidential Award, National Taiwan University (awarded to students ranking top 5%)*

Fall / Spring 2015, 2016, 2017, 2018

### Awards for Competition in Algorithm and Informatics:

*25th International Olympiad in Informatics, Bronze Medal*

Jul. 2013

*2013 Asia-Pacific Informatics Olympiad, Silver Medal*

May 2013

*National Informatics Olympiad in Taiwan, First Place*

Dec. 2012

## ORAL AND POSTER PRESENTATIONS

- [1] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at IST seminar series on Mathematics, Physics & Machine Learning, Mar. 17th, 2021.

- [2] "Power of data in quantum machine learning". Invited talk at SIAM Conference on Computational Science and Engineering, Mar. 3rd, 2021.
- [3] "Fundamental aspects of solving quantum problems with machine learning". Caltech Institute for Quantum Information and Matter (IQIM) Seminar, Feb. 26th, 2021.
- [4] "Fundamental aspects of solving quantum problems with machine learning". QuICS Seminar, University of Maryland, Feb. 17th, 2021.
- [5] "Fundamental aspects of solving quantum problems with machine learning". Contributed talk, 24rd Annual Conference on Quantum Information Processing (QIP-21), Jan. 30-31, 2021.
- [6] "Predicting Many Properties of a Quantum System from Very Few Measurements", National Taiwan University, Center for Quantum Science and Engineering, Dec. 18th, 2020.
- [7] "Predicting Many Properties of a Quantum System from Very Few Measurements", University College London, Quantum Information Seminar, Nov. 27th, 2020.
- [8] "Power of data in quantum machine learning", Centre for Quantum Technologies, Quantum Machine Learning Seminar, Nov. 26th, 2020.
- [9] "Predicting Many Properties of a Quantum System from Very Few Measurements", Caltech Institute for Quantum Information and Matter (IQIM) Seminar, Apr. 17th, 2020.
- [10] "Predicting Features of Quantum Systems using Classical Shadows", Single-track talk, 23rd Annual Conference on Quantum Information Processing (QIP-20), Jan. 6-10, 2020.
- [11] "Understanding Machine Reading Comprehension", Invited Talk, Academia Sinica, Oct 16, 2017.
- [12] "A Unified Algorithm for One-class Structured Matrix Factorization with Side Information", 31st AAAI Conference on Artificial Intelligence (AAAI-17), Feb. 4-9, 2017.
- [13] "Linear and Kernel Classification: When to Use Which?", SIAM International Conference on Data Mining (SDM16), May 5-8, 2016.
- [14] "Linear and Kernel Classifier: When to Use Which?", Spotlight presentation (acceptance rate: 11%), Machine Learning Summer School (MLSS'15), Kyoto University, August 23-September 4, 2015.
- [15] "Brief Introduction to Automatic Machine Learning", Science Exploration Forum, National Taiwan University, August 11, 2015.
- [16] "Dissecting Human Protein-Protein Interaction Network via Phylogenetic Decomposition." 14th International Conference on Systems Biology (ICSB2013), August 30-September 3, 2013.

## **SYNERGISTIC ACTIVITY**

Conference review: 34th Conference on Neural Information Processing Systems (2020), 23rd Annual Conference on Quantum Information Processing (2019).

Journal review: Physical Review A (2020), Quantum Machine Intelligence by Springer (2019).

Teaching Assistant: Introduction to the Theory of Computation (2017).

Conference volunteer: AAAI Conference on Artificial Intelligence (2017).

Conference review: Asia Pacific Bioinformatics Conference (2017).

Journal review: Data Mining and Knowledge Discovery (2016).

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**OTHER AWARDS AND HONORS**

<i>J. Yang Scholarship</i>	<i>Oct. 2020</i>
<i>Kortschak Scholarship</i>	<i>Oct. 2018</i>
<i>The Phi Tau Phi Scholastic Honor Society of the Republic of China</i>	<i>Jun. 2018</i>
<i>Undergraduate Research Project Exhibition, First Place</i>	<i>Jun. 2017</i>
<i>Appier Scholarship</i>	<i>Apr. 2016, Feb. 2017</i>
<i>AAAI Conference on Artificial Intelligence 2017 Scholarship</i>	<i>Feb. 2017</i>
<i>Shih-Liang Chien Memorial Award</i>	<i>May. 2016</i>
<i>SIAM International Conference on Data Mining 2016 Travel Award</i>	<i>Apr. 2016</i>
<i>Machine Learning Summer School 2015 Travel Award</i>	<i>Oct. 2015</i>
<i>Wang Da Gang Natural Science Scholarship</i>	<i>May 2013</i>
<i>Taiwan International Science Fair, Third Prize</i>	<i>Nov. 2012</i>
<i>Science Research Grant for High School Student, First Prize</i>	<i>Nov. 2012</i>
<i>Taipei High School Informatics Competition, First Place</i>	<i>Oct. 2012</i>
<i>Taipei High School Informatics Competition, Third Place</i>	<i>Oct. 2011</i>