



Szu Chi Chung

ASSISTANT PROFESSOR

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"If you can imagine it, you can achieve it. If you can dream it, you can become it."

Interests

I am an assistant professor at the Department of Applied Mathematics, National Sun Yat-sen University. Have received Ph.D. degree from National Chiao Tung University in Sep. 2017. I was a Postdoctoral research fellow from 2017 to 2021 at Institute of Statistical Science, Academia Sinica. I am interested in the area of data analysis and data security, including but not limited to:

Field	Machine learning, Clustering analysis and dimensional reduction, Cryo-EM and medical image analysis, Side-channel analysis, Security system design
Skill	Software programming (Python, Java, C, C++, CUDA), Big data framework (Spark, Hadoop), FPGA prototyping and hardware design

Education

	PH.D. IN INSTITUTE OF ELECTRONICS <i>National Chiao Tung University, Hsinchu, Taiwan.</i> <ul style="list-style-type: none">• Research Group: Star group of Silicon implementation lab (SI2)• Advisor: Chen-Yi Lee• Thesis topic: Stream Cipher and ID-Based Crypto Systems for IoT Applications• GPA 4.3/4.3, 34 credits	Sep. 2011 - Sep. 2017
	BS IN EECS UNDERGRADUATE HONORS PROGRAM <i>National Chiao Tung University, Hsinchu, Taiwan.</i> <ul style="list-style-type: none">• GPA 4.3/4.3, 159 credits	Sep. 2007 - Jun. 2011
	EXCHANGE STUDENT IN EECS <i>University of Illinois Urbana-Champaign, USA</i> <ul style="list-style-type: none">• GPA 4.0/4.0, 13 credits	Aug. 2010 - DEC. 2010
	HIGH SCHOOL GRADUATION <i>National Hualien High School, Taiwan</i>	Sep. 2004 - Jun. 2007

Honors & Awards

2022	Representative speaker of CSA , 2022 JSS-KSS-CSA International Statistical Symposium	Chinese Statistical Association (Taiwan)
2020	Best Paper Silver Award , 2020 ICCM Best Paper Silver Award	International Congress of Chinese Mathematicians
2020	Participants , Global Young Scientists Summit	National Research Foundation, Singapore
2019	Third Place , Poster Competition of Institute of Statistical Science	Academia Sinica
2016	Dragon Gate Program Scholarship (科技部龍門計畫) , Visiting Student Researcher to Stanford University	Ministry Of Science and Technology
2013	Second Prize , IE Design Contest, Core Technology Category (教育部 IE 競賽)	Ministry Of Education
2012	Bronze Medal Award , 12th Macronix Golden Silicon Award	Macronix Inc.
2012	First Prize , IC Design Contest, Cell-Based IC Category (教育部 IC 競賽)	Ministry Of Education
2010	EECS Study Aboard Scholarship , Exchange student program to University of Illinois Urban-Champaign	National Chiao Tung University

Academic and Working Experiences



ASSISTANT PROFESSOR

Aug. 2021 - PRESENT

Department of Applied Mathematics, National Sun Yat-sen University, Taiwan.



POSTDOCTORAL RESEARCHER

Dec. 2017 - July 2021

Institute of Statistical Science, Academia Sinica, Taiwan.

- Laboratory Director: I-Ping Tu [↗](#)
- Research Group: Statistical Analysis for Biological Image Data [↗](#)



POSTDOC SEMINARS HOST

Aug. 2018 - Jan. 2019

Institute of Statistical Science, Academia Sinica, Taiwan.

- Website: Postdoc Seminars [↗](#)



POSTDOCTORAL RESEARCHER

Oct. 2017 - Nov. 2017

Institute of Electronics, National Chiao Tung University, Taiwan.

- Laboratory Director: Chen-Yi Lee [↗](#)
- Research Group: Security for Trust And Reliability Group [↗](#)



VISITING STUDENT RESEARCHER

Nov. 2016 - Aug. 2017

Department of Statistics, Stanford University, USA.

- Advisor: Wing-Hung Wong [↗](#)
- Collaborator: Tung-Yu Wu



TEACHING ASSISTANT

Fall 2015

National Chiao Tung University, Taiwan.

- Course: Introduction to VLSI Design [↗](#)
- Lecturer: Chen-Yi Lee [↗](#)



TEACHING ASSISTANT

Fall 2011, Fall 2013 and Fall 2014

National Chiao Tung University, Taiwan.

- Course: Integrated Circuit Design Laboratory [↗](#)
- Lecturer: Chen-Yi Lee [↗](#) and Shyh-Jye Jou [↗](#)



TEACHING ASSISTANT

Fall 2014

National Chiao Tung University, Taiwan.

- Course: Digital Circuit and System
- Lecturer: Chen-Yi Lee [↗](#)



TEACHING ASSISTANT

2010-2014

National Chiao Tung University, Taiwan.

- Course: Electronics Laboratory (I) and (II)
- Lecturer: Meng-Wei Wang [↗](#)



TEACHING ASSISTANT

2012

National Chiao Tung University, Taiwan.

- Course: Digital Circuit Laboratory
- Lecturer: Chien Chen [↗](#)

Dissertation

- Szu-Chi Chung, “Stream Cipher and ID-Based Crypto Systems for IoT Applications [↗](#)”, *PhD dissertation*, (2017).

Academic Services

2021-2022 **Reviewer**, IEEE Transactions on Multimedia

2016-2017 **Reviewer**, IEEE Transactions on Circuits and Systems I (TCAS-I)

2016-2017 **Reviewer**, IEEE Transactions on Very Large Scale Integration Systems (TVLSI)

2016 **Reviewer**, IEEE Transactions on Computers

Research Projects

CRYO-EM AND MEDICAL IMAGE PROCESSING

Dec. 2017 - PRESENT



Academia Sinica, Taiwan

- Develop dimension reduction and clustering methods
- Accelerate clustering and alignment methods for cryo-EM
- Develop a unified platform for integrating different cryo-EM packages (Collaborating with Scipion team [↗](#))

NOVATEK-NCTU SIDE-CHANNEL ANALYSIS PROJECT

Jan. 2019 - PRESENT



Novatek Microelectronics, Taiwan

- Developing side-channel countermeasure for SM2/SM4 circuits
- Examining side-channel leakage using hypothesis testing

SCALABLE VIDEO ANALYSIS FRAMEWORK

Nov. 2016 - Sep. 2017



Stanford, USA

- Bridging the gap between distributed computation framework and traditional computer vision modules
- Provides a solution to deal with distributed video/image analysis in big data framework

BIG DATA SECURITY PROJECT

Sep. 2014 - Sep. 2017



Ministry of Science and Technology, Taiwan

- Develop several high throughput Bilinear Pairing modules to support cloud security protocols
- Propose guidelines to design security modules for big data system

DELTA-NCTU IOT PROJECT

Mar. 2014 - Mar. 2016



Delta Inc., Taiwan

- Develop stream ciphers that are suited to IoT scenario
- Design several implementation attacks and countermeasures
- Conduct side-channel attacks on the embedded system

E-HOME PROJECT

Aug. 2011 - Jun. 2014



National Science Council, Taiwan

- Develop AES and ECC modules that are suited for IoT use
- Integrate with other submodules including computer vision, wireless and memory modules

Invited Talks

- 2023/09/15, “Exploring the Conformational Landscape of Cryo-EM Using Energy-Aware Pathfinding Algorithm [↗](#)”, *Seminars of Data Science Degree Program in NTU*, (2023).
- 2023/07/13, “Exploring the conformational landscape of cryo-EM using a density-aware path-finding algorithm [↗](#)”, *International Conference for Statistics and Data Science*, (2023).
- 2023/02/18, “A new framework for cryo-EM 3D structure orientation estimation [↗](#)”, *The 31st Annual Meeting on Differential Equations and Related Topics*, (2023).
- 2022/10/18, “A framework for orientation recovery with uncertainty measure with the application in cryo-EM image analysis [↗](#)”, *Seminar of Graduate Institute of Statistics in NCU*, (2022).
- 2022/09/06, “Contrastive and self-supervise learning for Cryo-EM image analysis [↗](#)”, *2022 JSS-KSS-CSA International Statistical Symposium*, (2022).
- 2022/08/24, “Cryo-RALIB: A Modular Library for Accelerating Alignment in Cryo-EM [↗](#)”, *OpenACC and Hackathons Asia-Pacific Summit*, (2022).
- 2022/06/06, “Contrastive modeling for Cryo-EM 3D orientation estimations [↗](#)”, *The 5th International Conference on Econometrics and Statistics (EcoSta 2022)*, (2022).
- 2021/12/24, “Robust and rapid statistical learning method for Cryo-EM 3D conformation analysis [↗](#)”, *Seminar of Institute of Statistics in NTHU*, (2021).
- 2021/11/24, “A Rapid and Robust Network-Based Approach to Reveal the 3D Discrete Conformations of Protein Using Cryo-EM [↗](#)”, *Seminar of Institute of Statistics in NUK*, (2021).

- 2021/11/08, “Cryo-RALIB: A Modular Library for Accelerating Alignment in Cryo-EM ”, *GPU Technology Conference 2021* , (2021).
- 2021/10/14, “Discovering the Dynamics - Grouping 3D Structure Conformations Using Network Analysis on 2D Cryogenic Electron Microscopy (Cryo-EM) Projection Images ”, *Seminar of Department of Mathematics in NCKU* , (2021).
- 2021/05/06, “Grouping 3D Structure Conformations Using Network Analysis on 2D Cryogenic Electron Microscopy (Cryo-EM) Projection Images ”, *Seminar of Institute of Statistics in NYCU* , (2021).
- 2021/04/09, “Introduction to 3D conformation analysis - Eigen-analysis, 3DVA and AlphaCryo4D ”, *Workshop on Statistical Methods and Cryo-EM Data Analysis* , (2021).
- 2021/04/08, “Introduction to cryo-EM image processing - ASCEP and network conformation analysis ”, *Workshop on Statistical Methods and Cryo-EM Data Analysis* , (2021).
- 2021/03/20, “Toward computational conformation analysis of protein structure using Cryogenic Electron Microscopy (Cryo-EM) ”, *Statistical Conference in NCU* , (2021).
- 2021/03/17, “From snapshots to dynamic movies –toward computational conformation analysis of protein structure using Cryogenic Electron Microscopy (Cryo-EM) ”, *Seminar of NTHU ISA* , (2021).
- 2020/12/14, “Dimension reduction and clustering method for noisy high-dimensional images and application to Cryogenic Electron Microscopy ”, *NCTS Optimization Day for Young Researchers* , (2020).
- 2020/12/12, “Two-stage dimension reduction method and application to Cryogenic Electron Microscopy ”, *Waseda University-Academia Sinica joint workshop* , (2020).
- 2020/10/08, “Accelerated Cryo-EM Workflow ”, *GPU Technology Conference 2020* , (2020).
- 2019/12/27, “ASCEP - A Speedy and robust Cryo-EM processing Platform ”, *2019 Symposium On Statistical Analysis For Molecular Imaging And Biorhythms* , (2019).
- 2018/12/11, “A Dimension Reduction Method For Cryo-EM Image Processing ”, *2018 Workshop On High Dimensional Statistical Analysis* , (2018).
- 2018/03/14, “Scalable Video Analysis Framework ”, *Postdoc Seminars* , (2018).

Journal Paper

- I-Ping Tu, Yi-Ching Yao, Szu-Chi Chung, Shao-Hsuan Wang, Tze Leung Lai, “Uncertainty quantification in dynamic image reconstruction with applications to cryo-EM ”, *Accepted by Statistica Sinica* , (2022).
- Wei-Hau Chang, Shih-Hsin Huang, Hsin-Hung Lin, Szu-Chi Chung, I-Ping Tu, “Cryo-EM analyses permit visualization of structural polymorphism of biological macromolecules ”, *Frontiers in Bioinformatics* **74**, (2021).
- Wei-Hau Chang, Hsin-Hung Lin, I-Kuen Tsai, Shih-Hsin Huang , Szu-Chi Chung, I-Ping Tu, Steve Yu, Sunney I. Chan, “Copper Centers in the Cryo-EM Structure of Particulate Methane Monooxygenase Reveal the Catalytic Machinery of Methane Oxidation ”, *Journal of the American Chemical Society* **143**, (2021).
- Szu-Chi Chung, Shao-Hsuan Wang, Po-Yao Niu, Su-Yun Huang, Wei-Hau Chang, I-Ping Tu, “Two-stage dimension reduction for noisy high-dimensional images and application to Cryogenic Electron Microscopy ”, *Annals of Mathematical Sciences and Applications* **5**, (2020). (Receive 2020 ICCM Best Paper Silver Award).
- Szu-Chi Chung, Hsin-Hung Lin, Po-Yao Niu, Shih-Hsin Huang, I-Ping Tu, Wei-Hau Chang, “Pre-Pro is a Fast Pre-Processor for Single-Particle Cryo-EM by Enhancing 2D Classification ”, *Communications Biology* **3**, (2020).

- Szu-Chi Chung, Chun-Yuan Yu, Sung-Shine Lee, Hsie-Chia Chang, Chen-Yi Lee, “An Improved DPA Countermeasure Based on UDRPG for IoT Applications [↗](#)”, *IEEE Transactions on Circuits and Systems I (TCAS-I)* **64**, 2522–2531 (2017).
- Szu-Chi Chung, Jing-Yu Wu, Hsing-Ping Fu, Jen-Wei Lee, Hsie-Chia Chang, Chen-Yi Lee, “Efficient Hardware Architecture of η_T Pairing Accelerator Over Characteristic Three [↗](#)”, *IEEE Transactions on Very Large Scale Integration (VLSI) System* **23**, 88–97 (2015).
- Jen-Wei Lee, Szu-Chi Chung, Hsie-Chia Chang, Chen-Yi Lee, “Efficient Power-Analysis-Resistant Dual-Field Elliptic Curve Cryptographic Processor Using Heterogeneous Dual-Processing-Element Architecture [↗](#)”, *IEEE Transactions on Very Large Scale Integration (VLSI) System* **22**, 49–61 (2014).

Conference Paper

- Szu-Chi Chung, “Cryo-forum -A framework for orientation recovery with uncertainty measure with the application in cryo-EM image analysis [↗](#)”, *The 32nd South Taiwan Statistics Conference* , (2023).
- Szu-Chi Chung, Cheng-Yu Hung, Huei-Lun Siao, Hung-Yi Wu, Wei-Hau Chang, I-Ping Tu, “Cryo-RALib – a modular library for accelerating alignment in cryo-EM [↗](#)”, *IEEE International Conference on Image Processing (ICIP)* , 225-229 (2021).
- Szu-Chi Chung, Shao-Hsuan Wang, Cheng-Yu Hung, Wei-Hau Chang, I-Ping Tu, “rAMI –Rapid Alignment with Moment of Inertia for Cryo-EM Image Processing [↗](#)”, *Microscopy and Microanalysis 2021 Meeting* , (2021).
- Szu-Chi Chung, Hung-Yi Wu, Wei-Hau Chang, and I-Ping Tu, “Grouping 3D Structure Conformations using Network Analysis on 2D Cryo-EM Projection Images [↗](#)”, *Focus on Microscopy 2021* , (2021).
- Szu-Chi Chung, Shao-Hsuan Wang, Po-Yao Niu, Su-Yun Huang, I-Ping Tu, Wei-Hau Chang, “Accelerated cryo-EM workflow [↗](#)”, *The 29th South Taiwan Statistics Conference* , (2020).
- Szu-Chi Chung, Po-Yao Niu, Su-Yun Huang, Wei-Hau Chang, I-Ping Tu, “A Two-Stage Dimension Reduction Method For Cryo-EM Image Processing [↗](#)”, *Microscopy and Microanalysis 2019 Meeting* , (2019).
- Szu-Chi Chung, Po-Yao Niu, Su-Yun Huang, Wei-Hau Chang, I-Ping Tu, “A Dimension Reduction Method for cryo-EM Image Analysis [↗](#)”, *The 27th South Taiwan Statistics Conference* , (2018).
- Sung-Shine Lee, Szu-Chi Chung, Chun-Yuan Yu, Hsie-Chia Chang, Chen-Yi Lee, “A New Power Analysis Attack on Stream cipher Trivium-64 [↗](#)”, *VLSI Design/CAD Symposium (VLSI-CAD)* , (2015). Details. [↗](#)
- Szu-Chi Chung, Sung-Shine Lee, Hsie-Chia Chang, Chen-Yi Lee , “Implementing Bilinear Pairing Accelerator Using Residue Number System [↗](#)”, *VLSI Design/CAD Symposium (VLSI-CAD)* , (2014).
- Jen-Wei Lee, Szu-Chi Chung, Hsie-Chia Chang, Chen-Yi Lee, “A $3.40ms/GF(p_{521})$ and $2.77ms/GF(2^{521})$ DF-ECC Processor with Side-Channel Attack Resistance [↗](#)”, *IEEE International Solid-State Circuits Conference (ISSCC)* , 50–51 (2013).
- Jen-Wei Lee, Szu-Chi Chung, Hsie-Chia Chang, Chen-Yi Lee, “An Efficient Countermeasure against Correlation Power-Analysis Attacks with Randomized Montgomery Operations for DF-ECC Processor [↗](#)”, *Conference on Cryptographic Hardware and Embedded Systems (CHES)* , 548–564 (2012).
- Szu-Chi Chung, Jen-Wei Lee, Hsie-Chia Chang, Chen-Yi Lee, “High-performance elliptic curve cryptographic processor over $GF(p)$ with SPA resistance [↗](#)”, *IEEE International Symposium on Circuits and Systems (ISCAS)* , 1456–1459 (2012).

Preprints

- Teng-Yu Lin and Szu-Chi Chung, “Exploring the Conformational Landscape of Cryo-EM Using Energy-Aware Pathfinding Algorithm [↗](#)”, , (2023).

- Szu-Chi Chung, “Cryo-forum: A framework for orientation recovery with uncertainty measure with the application in cryo-EM image analysis”[↗](#), , (2023).
- Szu-Chi Chung, Hisn-Hung Lin, Kuen-Phon Wu, Ting-Li Chen, Wei-Hau Chang, and I-Ping Tu, “RE2DC: a robust and efficient 2D classifier with visualization tool for rapid processing massive and heterogeneous cryo-EM data”[↗](#), , (2022).
- Tze Leung Lai, Shao-Hsuan Wang, Yi-Ching Yao, Szu-Chi Chung, Wei-Hau Chang, and I-Ping Tu, “Cryo-EM: Breakthroughs in Chemistry, Structural Biology, and Statistical Underpinnings”[↗](#), *submitted to Statistical Science* , (2022).

Patents

- | | | |
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| 2019 | Cracking devices and methods thereof , 10277392 | <i>US Patent</i> |
| 2019 | Encryption/decryption apparatus and power analysis protecting method thereof , 10326586 | <i>US Patent</i> |

References

Dr. I-Ping Tu[↗](#)

(Advisor at Academia Sinica)

Institute of Statistical Science

Academia Sinica

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Dr. Chen-Yi Lee[↗](#)

(Ph.D. Advisor)

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National Chiao Tung University

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Dr. Hsie-Chia Chang[↗](#)

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