



# 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

National Chiao Tung University, Hsinchu, Taiwan.

- Research Group: Star group of Silicon implementation lab (SI2)
- Advisor: Chen-Yi Lee

Sep. 2011 - Sep. 2017



### BS IN EECS UNDERGRADUATE HONORS PROGRAM

National Chiao Tung University, Hsinchu, Taiwan.

Sep. 2007 - Jun. 2011



### EXCHANGE STUDENT IN EECS

University of Illinois Urbana-Champaign, USA

Aug. 2010 - DEC. 2010



### HIGH SCHOOL GRADUATION

National Hualien High School, Taiwan

Sep. 2004 - Jun. 2007

## Honors & Awards

2024	<b>Best Paper Award Winners</b> , 6th International Conference on Statistics: Theory and Applications	INTERNATIONAL ASET
2022	<b>Representative speaker of CSA</b> , 2022 JSS-KSS-CSA International Statistical Symposium	Chinese Statistical Association (Taiwan)
2020	<b>Best Paper Silver Award</b> , 2020 ICCM Best Paper Silver Award	International Congress of Chinese Mathematicians
2020	<b>Participants</b> , Global Young Scientists Summit	National Research Foundation, Singapore
2019	<b>Third Place</b> , Poster Competition of Institute of Statistical Science	Academia Sinica
2016	<b>Dragon Gate Program Scholarship</b> (科技部龍門計畫), Visiting Student Researcher to Stanford University	Ministry Of Science and Technology
2013	<b>Second Prize</b> , IE Design Contest, Core Technology Category (教育部 IE 競賽)	Ministry Of Education
2012	<b>Bronze Medal Award</b> , 12th Macronix Golden Silicon Award	Macronix Inc.
2012	<b>First Prize</b> , IC Design Contest, Cell-Based IC Category (教育部 IC 競賽)	Ministry Of Education
2010	<b>EECS Study Aboard Scholarship</b> , 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

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### 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

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- 2024/09/25, “A Novel Particle Picking Pipeline for Cryo-EM Using Semantic Segmentation and Conditional Random Field [↗](#)”, *Seminar of Department of Mathematics in CCU* , (2024).
- 2024/08/20, “A Novel Particle Picking Pipeline for Cryo-EM Using Semantic Segmentation and Conditional Random Field [↗](#)”, *6th International Conference on Statistics: Theory and Applications* , (2024).
- 2024/03/19, “Exploring the Conformational Landscape of Cryo-EM Using Energy-Aware Pathfinding Algorithm [↗](#)”, *Seminar of Graduate Institute of Statistics in NCU* , (2024).
- 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

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- Teng-Yu Lin and Szu-Chi Chung, “CLEAPA: a framework for exploring the conformational landscape of cryo-EM using energy-aware pathfinding algorithm [↗](#)”, *Bioinformatics* **40**, 6 (2024).
- Szu-Chi Chung, “Cryo-forum: A framework for orientation recovery with uncertainty measure with the application in cryo-EM image analysis [↗](#)”, *Journal of Structural Biology* **216**, 108058 (2024).
- 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 [↗](#)”, *Statistica Sinica* **33**, 1771–1788 (2023).
- 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**, 788308 (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**, 9922–9932 (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**, 283–316 (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**, 508 (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  $\eta_T$  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



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- Szu-Chi Chung, “A Novel Particle Picking Pipeline for Cryo-EM Using Semantic Segmentation and Conditional Random Field”, *6th International Conference on Statistics: Theory and Applications*, (2024).
- 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

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


## References

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### Dr. I-Ping Tu

(Advisor at Academia Sinica)  
Institute of Statistical Science  
Academia Sinica  
✉ [iping@stat.sinica.edu.tw](mailto:iping@stat.sinica.edu.tw) 

### Dr. Chen-Yi Lee

(Ph.D. Advisor)  
Department of Electronics Engineering  
National Chiao Tung University  
✉ [cylee@si2lab.org](mailto:cylee@si2lab.org) 

### Dr. Hsie-Chia Chang

(Ph.D. Co-Advisor)  
Department of Electronics Engineering  
National Chiao Tung University  
✉ [hcchang@mail.nctu.edu.tw](mailto:hcchang@mail.nctu.edu.tw) 

### Dr. Wing Hung Wong

(Advisor at Stanford)  
Department of Statistics  
Stanford University  
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