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   Sep. 2011 - Sep. 2017
National Chiao Tung University, Hsinchu, Taiwan.
- 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

BS IN EECS UNDERGRADUATE HONORS PROGRAM   Sep. 2007 - Jun. 2011
National Chiao Tung University, Hsinchu, Taiwan.
- GPA 4.3/4.3, 159 credits

EXCHANGE STUDENT IN EECS   Aug. 2010 - DEC. 2010
University of Illinois Urbana-Champaign, USA
- GPA 4.0/4.0, 13 credits

HIGH SCHOOL GRADUATION   Sep. 2004 - Jun. 2007
National Hualien High School, Taiwan

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

- 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

- 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 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, 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

2019	**Cracking devices and methods thereof**, 10277392	*US Patent*
2019	**Encryption/decryption apparatus and power analysis protecting method thereof**, 10326586	*US Patent*

References

Dr. I-Ping Tu ⧉
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