

# Szu Chi Chung

#### **ASSISTANT PROFESSO**

Department of Applied Mathematics, National Sun Yat-sen University. No.70 Lien-hai Rd., Kaohsiung 80424, Taiwan

"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	Invited Speaker, 2022 JSS-KSS-CSA International Statistical Symposium ☑	Chinese Statistical
2022	merced opearer, 2022 300 Roo Continentational Statistical Symposium	Association (Taiwan)
2020	<b>Best Paper Silver Award</b> , 2020 ICCM Best Paper Silver Award ☑	International Congress of
		Chinese Mathematicians
2020	Participants, Global Young Scientists Summit ☑	National Research
		Foundation, Singapore
2019	<b>Third Place</b> , 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	Ministry Of Science and
2016	Stanford University	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	<b>EECS Study Aboard Scholarship</b> , Exchange student program to University of Illinois	National Chiao Tung
	Urban-Champaign	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



- 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**

- 2022/08/24, "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 7, 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 (7), 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) 7, 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 "C", 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\_\_\_\_

- 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  $\eta_T$  Pairing Accelerator Over Characteristic Three  $\mathbb{Z}$ ", 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 7", IEEE Transactions on Very Large Scale Integration (VLSI) System 22, 49–61 (2014).

## **Conference Paper**

• 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 7", *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.
- <u>Szu-Chi Chung</u>, 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  $\ref{eq:condition}$ ", 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 7, 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**\_

- Szu-Chi Chung, Hisn-Hung Lin, Tien-You Liu, Kuen-Phon Wu, Wei-Hau Chang, and I-Ping Tu, "Accelerating the stream of single particle cryo-EM analysis with DRMRA ?", *In preparation*, (2022).
- 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 ?", submitted to Statistica Sinica, (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

 $\frac{\text{Encryption/decryption apparatus and power analysis protecting method thereof,}}{10326586}$ 

**US Patent** 

### References\_

### Dr. I-Ping Tu

(Advisor at Academia Sinica) Institute of Statistical Science Academia Sinica

☑ iping@stat.sinica.edu.twび

### Dr. Hsie-Chia Chang ☑

(Ph.D. Co-Advisor)
Department of Electronics Engineering
National Chiao Tung University

### Dr. Chen-Yi Lee 🗹

(Ph.D. Advisor) Department of Electronics Engineering National Chiao Tung University

✓ cylee@si2lab.org 🖸

### Dr. Wing Hung Wong ☑

(Advisor at Stanford) Department of Statistics Stanford University

whwong@stanford.edu