

PERSONAL PARTICULARS

FIRST NAME : Cheng-Yaw
LAST NAME : Low
NATIONALITY : Malaysian
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**ACADEMIC BACKGROUND**

DEGREE : Ph.D. in Electrical and Electronic Engineering
THESIS TITLE : Stacking-based Deep Neural Networks for Pattern Classification
NAME OF INSTITUTE : Yonsei University, Republic of Korea
SUPERVISOR : Prof. Andrew Beng-Jin Teoh
GRADUATION DATE : February 20, 2018

DEGREE : Master of Science (Information Technology)
THESIS TITLE : Offline Handwritten Signature Watermarking for Digital Document Authentication
NAME OF INSTITUTE : Multimedia University, Malaysia
SUPERVISOR : Prof. Andrew Beng-Jin Teoh
GRADUATION DATE : November 18, 2009

DEGREE : Bachelor of Information Technology (Hons) in Data Communications
THESIS TITLE : Geographic Information System for Flood Forecasting
NAME OF INSTITUTE : Multimedia University, Malaysia
SUPERVISOR : Dr. Meng-Chew Leow
GRADUATION DATE : June 3, 2004

EMPLOYMENT HISTORY

- MARCH. 2022 – PRESENT : **Research Associate**
 Institute for Basic Science (IBS),
 Data Science Group,
 Center for Mathematical and Computational Sciences,
 Republic Korea.
- NOV. 2019 – FEB. 2022 : **Postdoctoral Researcher**
 Yonsei University,
 School of Electrical and Electronic Engineering,
 Republic of Korea.
- MAR. 2018 – OCT. 2019 : **Lecturer w/ Ph.D. (Tenure-Track)**
 Faculty of Information Science and Technology,
 Multimedia University, Malaysia
- NOV. 2009 – FEB. 2018 : **Lecturer w/o Ph.D.**
 Faculty of Information Science and Technology,
 Multimedia University, Malaysia
- APR. 2008 – OCT. 2009 : **Assistant Lecturer**
 Faculty of Information Science and Technology,
 Multimedia University, Malaysia
- APR. 2005 – MAR. 2008 : **Tutor**
 Faculty of Information Science and Technology,
 Multimedia University, Malaysia

TEACHING PROFILE

- My teaching profession commenced from 2005 as a tutor with the Faculty of Information Science and Technology, Multimedia University (MMU), Malaysia. During my 15-year adventure at MMU (from a tutor/an assistance lecturer to a tenure-track lecturer), I delivered several Computer Science courses (in English), including but not limited to:
 1. Programming in C/C++
 2. Data Structures and Algorithms
 3. Introduction to Machine Learning
 4. Pattern Recognition
 5. Artificial Intelligence
 6. Mathematical Techniques
 7. Software Engineering Fundamentals
 8. Digital Watermarking
- On average, I was evaluated 4.5/5.0 in the student academic assessment.

RESEARCH PROFILE

- **RESEARCH INTEREST**

1. My research interests are computer vision and pattern recognition of which deep neural networks (DNN) for object recognition is in focus, particularly biometrics recognition including face, hand gesture and handwritten signature. Recently, I am interested in the new challenges of biometric recognition, including realistic low-resolution face recognition and periocular recognition.
2. Other interesting topics are the lightweight DNN for mobile platform, the DNN-learned biometric template protection, and other innovative artificial intelligence and machine learning applications, e.g., data science and energy optimization.
3. Several SCI/E journals are authored in the recent three years, including IEEE Transactions on Image Processing (TIP), IEEE Transactions on Cybernetics (TCB) and IEEE Circuit Systems, and Video Technology (TCSVT), along with other peer-reviewed international conference papers.
4. During my 4-year Ph.D. studies with Yonsei University, Republic of Korea, I participated actively in research and industrial projects funded by National Research Foundation (NRF) of Korea and Electronics and Telecommunications Research Institute (ETRI).

- **PROGRAMMING SKILLS**

Python (PyTorch, TensorFlow), MATLAB, C++, C

PUBLICATION LIST

(SORTED BY PUBLICATION YEAR)

- **SELECTED JOURNAL**

(PUBLISHED / ACCEPTED IN IN RECENT THREE YEARS)

1. Jaewoo Park, **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, “Divergent Angular Representation for Open-Set Image Recognition,” *IEEE Transactions on Image Processing* (ISSN: 1057-7149, IF: 9.340, SCI), Accepted on Nov. 7, 2021.
2. Sanghak Lee, **Cheng-Yaw Low**, Jaihie Kim, and Andrew Beng-Jin Teoh, “Robust Sclera Recognition based on a Local Spherical Structure,” *Expert Systems with Applications*, (ISSN: 0957-4174, IF: 6.954, SCI), Accepted on Oct. 11, 2021.
3. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Jaewoo Park, “MIND-Net: A Deep Mutual Information Distillation Network for Realistic Low-Resolution Face Recognition,” *IEEE Signal Processing Letters* (ISSN: 1070-9908, IF: 3.109, SCIE), vol. 28, pp. 354-358, Jan. 2021.
4. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Jaewoo Park, “Stacking-Based Deep Neural Networks Deep Analytic Network for Pattern Classification,” *IEEE Transactions on Cybernetics* (ISSN: 2168-2267, IF: 11.448, SCI), vol. 50, no. 12, pp. 5021-5034, Dec. 2020.
5. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Cong-Jie Ng “Multi-Fold Gabor, PCA, ICA Filter Convolution Descriptor for Face Recognition”, *IEEE Transactions on Circuits and Systems for Video Technology* (ISSN: 1051-8215, IF: 4.685, SCI), vol. 29(1), pp. 115-129, Jan. 2019.

- **JOURNAL**

(PUBLISHED / ACCEPTED, SORTED BY PUBLICATION DATE)

1. Jaewoo Park, **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, “Divergent Angular Representation for Open-Set Image Recognition,” *IEEE Transactions on Image Processing* (ISSN: 1057-7149, IF: 9.340, SCI), Accepted on Nov. 7, 2021.
2. Sanghak Lee, **Cheng-Yaw Low**, Jaihie Kim, and Andrew Beng-Jin Teoh, “Robust Sclera Recognition based on a Local Spherical Structure,” *Expert Systems with Applications*, (ISSN: 0957-4174, IF: 6.954, SCI), Accepted on Oct. 11, 2021.
3. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Jaewoo Park, “MIND-Net: A Deep Mutual Information Distillation Network for Realistic Low-Resolution Face Recognition,” *IEEE Signal Processing Letters* (ISSN: 1070-9908, IF: 3.109, SCIE), vol. 28, pp. 354-358, Jan. 2021.
4. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Jaewoo Park, “Stacking-Based Deep Neural Networks Deep Analytic Network for Pattern Classification,” *IEEE Transactions on Cybernetics* (ISSN: 2168-2267, IF: 11.448, SCI), vol. 50, no. 12, pp. 5021-5034, Dec. 2020.
5. Yong-Soon Tan, Kian-Ming Lim, Connie Tee, Chin-Poo Lee, and **Cheng-Yaw Low**, “Convolutional Neural Network with Spatial Pyramid Pooling for Hand Gesture Recognition,” *Neural Computing and Applications* (ISSN: 0941-0643, IF: 5.606, SCI), pp. 1-13, Sept. 2020.
6. Yoon-Gyo Jung, **Cheng-Yaw Low**, Jae-Woo Park, and Andrew Beng-Jin Teoh, “Periocular Recognition in the Wild with Generalized Label Smoothing Regularization,” *IEEE Signal Processing Letters* (ISSN: 1070-9908, IF: 3.109, SCIE), vol. 27, pp. 1455-1459, Aug. 2020.
7. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Cong-Jie Ng “Multi-Fold Gabor, PCA, ICA Filter Convolution Descriptor for Face Recognition”, *IEEE Transactions on Circuits and Systems for Video Technology* (ISSN: 1051-8215, IF: 4.685, SCI), vol. 29(1), pp. 115-129, Jan. 2019.
8. Cong-Jie Ng, **Cheng-Yaw Low**, and Andrew Beng-Jin Teoh, “Orthogonal Filter Banks with Region Log-TiedRank Covariance Matrix for Face Recognition,” *Journal of Visual Communication and Image Representation* (ISSN: 1047-3203, IF: 2.678, SCIE), vol. 55, pp. 548-560, Aug. 2018.
9. In-Ho Chang, **Cheng-Yaw Low**, and Andrew Beng-Jin Teoh, “Kernel Deep Regression Network for Touch-Stroke Dynamics Authentication”, *IEEE Signal Processing Letters* (ISSN: 1070-9908, IF: 3.109, SCIE), vol. 25(7), pp. 1109-1113, July 2018.
10. Ying-Han Pang, Andrew Beng-Jin Teoh, Shih-Yin Ooi, and **Cheng-Yaw Low**, “Enhanced Independent Spectral Histogram Representations in Face Recognition”, *Multimedia Tools and Applications* (ISSN: 1380-7501, IF: 2.757, SCIE), vol. 77(11), pp. 14259-14284, June 2018.
11. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Kar-Ann Toh, “Stacking PCANet+: An Overly Simplified ConvNets Baseline for Face Recognition”, *IEEE Signal Processing Letters* (ISSN: 1070-9908, IF: 3.109, SCIE), vol. 24(11), pp. 1581-1586, Nov. 2017.

- **CONFERENCE PROCEEDINGS**

(PUBLISHED / ACCEPTED)

1. Hak-Young Lee, **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, “SoftmaxOut Transformation-Permutation Network for Facial Template Protection,” in *Proc. IEEE International Conference on Pattern Recognition (ICPR)*, Accepted on 20 Oct. 2020.
2. **Cheng-Yaw Low**, and Andrew Beng-Jin Teoh, “Stacking-Based Deep Neural Network: Deep Analytic Network on Convolutional Spectral Histogram Features,” in *Proc. IEEE International Conference on Image Processing (ICIP)*, pp. 1592-1596, Sept. 2017, Beijing, China.
3. **Cheng-Yaw Low**, and Andrew Beng-Jin Teoh, “Finessing Filter Scarcity Problem for Face Recognition via Multi-Fold Filter Convolution,” in *Proc. International Workshop on Pattern Recognition (IWPR)*, vol. 10443, pp. 104430G, May 2017, Singapore.
4. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Cong-Jie Ng, “Multi-Fold Gabor Filter Convolution Descriptor for Face Recognition,” in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 2094-2098, Mar. 2016, Shanghai, China.
5. Cong-Jie Ng, Andrew Beng-Jin Teoh, and **Cheng-Yaw Low**, “DCT-Based Region Log TiedRank Covariance Matrices for Face Recognition,” in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pp. 2099-2103, Mar. 2016, Shanghai, China.
6. Yeong-Khang Lee, **Cheng-Yaw Low**, and Andrew Beng-Jin Teoh, “Tensor Kernel Supervised Dictionary Learning for Face Recognition,” in *Proc. Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, pp. 623-629, Dec. 2015, Hong Kong.
7. **Cheng-Yaw Low**, “Learning Compact Local Face Descriptors with VLAD,” in *Proc. Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, pp. 825-833, Dec. 2015, Hong Kong.
8. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Connie Tee, “Fusion of LSB and DWT Biometric Watermarking using Offline Handwritten Signature for Copyright Protection,” in *Proc. International Conference on Biometrics (ICB)*, pp. 786-795, June 2009, Italy.
9. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Connie Tee, “Support Vector Machines (SVM)-based Biometric Watermarking for Offline Handwritten Signature,” in *Proc. IEEE International Conference on Industrial Electronics and Applications*, pp. 2095-2100, June 2008, Singapore.
10. **Cheng-Yaw Low**, Andrew Beng-Jin Teoh, and Connie Tee, “A Preliminary Study on Biometric Watermarking for Offline Handwritten Signature,” in *Proc. International Conference on Telecommunications and Malaysia International Conference on Communications (ICT-MICC)*, pp. 691-696, May 2007, Malaysia.

- **COMPLETE PUBLICATION LIST**

<https://scholar.google.com.my/chengyawlow>

RESEARCH GRANTS / INDUSTRIAL PROJECTS

(SORTED BY PROJECT DURATION)

1. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “IoT-Platform Surveillance Low-Resolution Face Recognition with Dual-Role Face Hallucination” *National Research Foundation of Korea (NRF)*, 157,500,000 KRW (\approx 138,000 USD), Oct. 1, 2019 - Dec. 31, 2021.
2. **Principal Investigator**, “A Real-Time Two-Way Sign Language to Speech/Text Translation System for Bridging Communication with Hearing-Impaired Community”, *Multimedia University Internal Research Funding*, 20,000 RM (\approx 4,810 USD), May 01, 2019 - Apr. 30, 2020.
3. **Project Member** (Principal Investigator: Dr. Kian-Ming Lim, Multimedia University, Malaysia), “Human Behavior Perception Through Deep Learning”, *Multimedia University Internal Research Funding*, 25,842 RM (\approx 6,300 USD), Sept. 20, 2018 - Sept. 19, 2019.
4. **Project Member** (Principal Investigator: Dr. Kian-Ming Lim, Multimedia University, Malaysia), “Smart Mirror using Face Recognition Through Deep Learning”, *Multimedia University Internal Research Funding*, 21,715 RM (\approx 5,400 USD), May 1, 2018 - Apr. 30, 2019.
5. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “Continuous User Identification and Biometric Key Extraction by Mining Touch Gesture in Mobile Devices - 2/3”, *National Research Foundation of Korea (NRF)*, 71,583,000 KRW (\approx 66,000 USD), June 1, 2017 - Mar. 31, 2018.
6. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “A One-Factor Cancellable Fingerprint Key Generation Cryptosystem”, *Electronics and Telecommunications Research Institute (ETRI)*, 50,000,000 KRW (\approx 46,000 USD), Apr. 1, 2017 - Oct. 31, 2017.
7. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “Hybrid Cancellable Fingerprint Cryptosystem”, *Electronics and Telecommunications Research Institute (ETRI)*, 50,000,000 KRW (\approx 46,000 USD), July 1, 2016 - Nov. 30, 2016.
8. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “Continuous User Identification and Biometric Key Extraction by Mining Touch Gesture in Mobile Devices - 1/3”, *National Research Foundation of Korea (NRF)*, 85,570,000 KRW (\approx 79,000 USD), June 1, 2016 - May 31, 2017.
9. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “Machine Learning Inspired Multimodal Keys Computation and Application - 3/3”, *National Research Foundation of Korea (NRF)*, 51,480,000 KRW (\approx 48,000 USD), June 1, 2015 - May 31, 2016.
10. **Project Member** (Principal Investigator: Prof. Andrew Beng-Jin Teoh, Yonsei University, Republic of Korea), “Machine Learning Inspired Multimodal Keys Computation and Application - 2/3”, *National Research Foundation of Korea (NRF)*, 51,480,000 KRW (\approx 48,000 USD), June 1, 2014 - May 31, 2015.

PROFESSIONAL SERVICES

- **REVIEWER FOR JOURNAL / CONFERENCE**
 1. IEEE Transactions on Information Forensics and Security
 2. IEEE Transactions on Neural Networks and Learning Systems
 3. IEEE Transactions on Biometrics, Behavior, and Identity Science
 4. IEEE Signal Processing Letters
 5. Nature Scientific Journal
 6. Pattern Recognition Letters
 7. Machine Learning with Applications
 8. Measurement and Control
 9. F1000 Research
 10. IEEE International Conference on Image Processing (ICIP 2017 – 2020)
 11. IEEE International Conference on Pattern Recognition (ICPR 2016 - 2019)
 12. Annual Conference of the European Association for Computer Graphics (Eurographics 2019)
 13. IEEE International Workshop on Multimedia Signal Processing (MMSP 2019)
 14. International Workshop on Information Forensics and Security (WIFS 2016)
 15. IEEE International Conference on Control, Automation, Robotics and Vision (ICARCV 2016)

- **INVITED TALK / EXTERNAL COURSE / TECHNICAL COMMITTEE**
 1. **Invited Speaker**, “Periocular Recognition and Surveillance Face Recognition”, *Summer School*, Gachon University, Republic of Korea, 15 July 2021.
 2. **Invited Speaker**, “Revisiting Face Recognition and New Challenges”, *Malaysia-Germany Webinar – InnovationLabs.my*, 11 March 2021.
 3. **Invited Judge**, *SUPREME 2019*, Manchester Metropolitan University, United Kingdom, 8 November 2019.
 4. **Invited Speaker**, “A Deep Neural Network Alternative: Stacking-Based Deep Neural Networks for Object Pattern”, *International Workshop on Intelligent Systems, Advanced Manufacturing, and Assistive Technology*, National Chung Cheng University, Taiwan, 22 July 2019 – 30 Aug. 2019.
 5. **Instructor**, “Machine Learning with Python”, Multimedia University, Malaysia, 1 December 2018 – 5 January 2019.
 6. **Chairperson**, IEEE National Postgraduate Poster Competition, University Science of Malaysia, 22 Aug. 2019.
 7. **Technical Committee**, International Conference on Information and Communication Technology (ICoICT 2018 – 2019).

SUPERVISION

(POSTGRADUATE / UNDERGRADUATE)

- **POSTGRADUATE SUPERVISION**
 1. **Co-Supervision**, Multimedia University, Malaysia – 1 Completed
- **UNDERGRADUATE FINAL YEAR PROJECT SUPERVISION**
 1. **Supervision**, Multimedia University, Malaysia – 22 Completed
 2. **Co-Supervision**, Yonsei University, Republic of Korea – 2 On-Going, 2 Completed

UNIVERSITY / FACULTY SERVICES

- **DISSERTATION / MASTER THESIS EXAMINER**
 1. **Ph.D.**, “Sclera Recognition: Novel Matching Technique-based on Local Spherical Structure”, Yonsei University, Republic of Korea, Dec. 21, 2020.
 2. **Master**, “SoftmaxOut Dropout Transformation Network for Facial Template Protection”, Yonsei University, Republic of Korea, Dec. 21, 2020.
 3. **Master**, “Facial Template Protection through Deep Index-of-Maximum Hashing”, June 15, 2020.
 4. **Master**, “Human Action Recognition with Deep Learning”, Multimedia University, Malaysia, Apr. 01, 2019.
 5. **Master**, “Detection and Recognition of Abnormal Behavior in Video Sequences”, Multimedia University, Malaysia, July 30, 2018.
 6. **Master**, “Multimodal Identification for Targeted Advertising”, Multimedia University, Malaysia, Apr. 3, 2018.
- **OTHER UNIVERSITY SERVICES**
 1. **Deputy Chairperson**, Master of Information Technology Program, Session 2019/20, Multimedia University, Malaysia.
 2. **Deputy Chairperson**, Center of Ubiquitous Computing and Communication, Session 2018/19/20, Multimedia University, Malaysia.
 3. **Coordinator/Instructor**, Machine Learning with Python, Session 2018/2019, Multimedia University, Malaysia.
 4. **COMMITTEE MEMBER**, Student Affairs and Alumni Committee, Session 2018/19/20, Multimedia University, Malaysia.
 5. **COMMITTEE MEMBER**, Student Industrial Training, Session 2018/19, Multimedia University, Malaysia.

REFERENCE LIST

- REFEREE (1)** : Andrew Beng-Jin Teoh
POSITION : Professor
NAME OF INSTITUTE : School of Electrical and Electronic Engineering,
Yonsei University, Republic of Korea
RELATIONSHIP : Ph.D. / Master Supervisor
EMAIL : bjteoh@yonsei.ac.kr
- REFEREE (2)** : Kwanghoon Sohn
POSITION : Professor
NAME OF INSTITUTE : School of Electrical and Electronic Engineering,
Yonsei University, Republic of Korea
RELATIONSHIP : Ph.D. Examiner
EMAIL : khsohn@yonsei.ac.kr
- REFEREE (3)** : Swee-Huay Heng
POSITION : Professor
NAME OF INSTITUTE : Faculty of Information Science and Technology (FIST)
Multimedia University (MMU), Malaysia
RELATIONSHIP : Vice President of MMU (2013–2017), Dean of FIST (2011–2013)
EMAIL : shheng@mmu.edu.my
- REFEREE (4)** : Kok-Seng Wong
POSITION : Associate Professor
NAME OF INSTITUTE : College of Engineering and Computer Science,
VinUniversity, Vietnam
RELATIONSHIP : Research Collaborator, Co-Worker at MMU (2009)
EMAIL : wong.ks@vinuni.edu.vn