

# WORKSHOP 5

## Recent advances in Machine Intelligence

Date : 15 January 2016 (Friday)  
Time : 9:30 a.m. – 1:00 p.m.  
Venue : Conference Hall 1-2, G/F, Core Building 1, Phase 1, Hong Kong Science Park, Shatin, Hong Kong

Topic 1 : **Face Recognition from Low-resolution to High-resolution**  
Speaker : **Prof. Kenneth Lam**, Associate Dean and Professor, PolyU EIE

### Abstract

A lot of research on face recognition has been conducted over the past two decades or more. Various face recognition methods have been proposed, but investigations are still underway to tackle different problems and challenges for face recognition. The existing algorithms can only solve some of the problems, and their performances degrade in real-world applications. In this talk, we will first discuss the performances of face recognition techniques on face images at different resolution. To perform face recognition, image features from a query image are first extracted and then matched to those features in a gallery set. The amount of information and the effectiveness of the features used will determine the recognition performance. To improve the performance, we will present a face recognition approach using information about face images at higher and lower resolutions, which can enhance the information content of the features that are extracted and combined at different resolutions. As the features from different resolutions should closely correlate with each other, we employ the cascaded generalized canonical correlation analysis (GCCA) to fuse the information to form a single feature vector for face recognition. To further improve the performance and efficiency, "Gabor-Feature Hallucination" is used to predict the high-resolution (HR) Gabor features from the Gabor features of a face image directly by using local linear regression. We also extend the algorithm to low-resolution (LR) face recognition, in which the medium-resolution (MR) and HR Gabor features of a LR input image are estimated directly. The LR Gabor features and the predicted MR and HR Gabor features are then fused using GCCA for LR face recognition. This approach can avoid having to perform the interpolation/super-resolution of face images and having to extract HR Gabor features.

For recognition of HR face images, we will show that pore-scale facial features can be explored when the resolution of faces is greater than 700x600 pixels. We will describe the use of the facial features for recognition under conditions of different facial expressions, lighting, poses and captured times. We will also present the minimum area in face images that can retain a high recognition level. Experiment results indicate that the facial pores can be used as a new biometric for recognition, even distinguishing between identical twins.

### Biography

**Prof. Kin-Man Lam** received the Associateship in Electronic Engineering with distinction from The Hong Kong Polytechnic University (formerly called Hong Kong Polytechnic) in 1986, the M.Sc. degree in communication engineering from the Department of Electrical Engineering, Imperial College of Science, Technology and Medicine, London, U.K., in 1987, and the Ph.D. degree from the Department of Electrical Engineering, University of Sydney, Sydney, Australia, in August 1996.

From 1990 to 1993, he was a Lecturer at the Department of Electronic Engineering, The Hong Kong Polytechnic University. He joined the same Department as an Assistant Professor in October 1996, became an Associate Professor in 1999, and has been a Professor since 2010. He has been a member of the organizing committee and program committee of many international conferences. Prof. Lam was also the Chairman of the IEEE Hong Kong Chapter of Signal Processing between 2006 and 2008. Between 2009 and 2013, he was an Associate Editor of IEEE Trans. on Image Processing.

Currently, Prof. Lam is VP-Member Relations and Development of the Asia-Pacific Signal and Information Processing Association (APSIPA), and the Director-Membership Services of the IEEE Signal Processing Society. He serves as an Associate Editor of Digital Signal Processing, APSIPA Trans. on Signal and Information Processing, and EURASIP International Journal on Image and Video Processing. He is also an Editor of HKIE Transactions, and an Area Editor of IEEE Signal Processing Magazine. He is a General Co-Chair of the 2015 APSIPA Annual Summit and Conference and the 2017 IEEE International Conference on Multimedia Expo, both to be held in Hong Kong. His current research interests include human face recognition, image and video processing, and computer vision.

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## Topic 2 : **Speaker Verification under the Big Data Environment**

Speaker : **Dr M.W. Mak**, Associate Professor, PolyU EIE

### Abstract

The recent increase in identity theft has drawn the public attention to the potential risk of using remote services. In fact, frauds and identity theft are on the rise in Hong Kong and mainland China because of the popularity of using mobile phones to access remote services. Traditionally, authentication of these services relies on usernames and passwords. This authentication method, however, is no longer adequate for safeguarding the security of remote services. The recent advance in speaker recognition technology has demonstrated that voice biometrics could be an important part of the authentication process. For example, using speaker recognition technologies, the identity of a caller can be verified in a live call and financial transactions can be stopped if fraud is detected. Voice biometrics can also help call centers to reduce the risk of leaking customers' information caused by social engineering fraudulence.

This talk will introduce the principles behind current state-of-the-art speaker recognition systems. It will cover various components and processing stages of a speaker recognition system, including feature extraction, i-vector extraction, probabilistic linear discriminant analysis, and deep neural networks. Then, the potential problems of the current methods when the data volume increases will be discussed. Finally, the talk will explain how parallel processing technologies such as MapReduce and Hadoop can be applied to overcome the problems in large-scale biometric applications.

### Biography

**Dr Man-Wai Mak** received a BEng(Hons) degree in Electronic Engineering from Newcastle Upon Tyne Polytechnic in 1989 and a PhD degree in Electronic Engineering from University of Northumbria at Newcastle (now Northumbria University) in 1993. He joined the Department of Electronic and Information Engineering at The Hong Kong Polytechnic University in 1993, and presently is an Associate Professor. Dr Mak has taught courses in speech processing, neural computation, software engineering, objected-oriented design and programming, database systems, and distributed systems and cloud computing. He has authored more than 150 technical articles in speaker recognition, machine learning, and bioinformatics, and served as a guest editor of international journals. He has served as an associate editor of IEEE Trans. on Audio, Speech and Language Processing, Journal of Signal Processing Systems, Advances in Artificial Neural Systems, and Conference Papers in Biology. Dr Mak is also a co-author of the postgraduate textbook "Biometric Authentication: A Machine Learning Approach, Prentice Hall, 2005." and "Machine Learning for Protein Subcellular Localization Prediction, De Gruyter, 2015". He has received two Faculty of Engineering Research Grant Achievement Awards. He is also experienced in software design and implementation, and he has provided consultancy services to companies in Hong Kong. Since 1995, Dr Mak has been an Executive Committee member of the IEEE Hong Kong Section Computer Chapter. He was the Chairman of the IEEE Hong Kong Section Computer Chapter in 2003-2005. He also served as a member of the IEEE Machine Learning for Signal Processing Technical Committee in 2005-2007 and a member of Technical Committee Member, IEEE Computation Intelligence Society, Intelligent Systems Applications in 2008. Dr Mak has served as a Program Committee member of a number of international conferences, including MLSP'06-2010, BIBE'07, PCM'07 (Track Co-Chair), ICMLC'20007-2011, APSIPA'09-2011, ISCSLP'08-14, Area Chair of Interspeech'2014, etc. Dr Mak's research interests include speaker recognition, machine learning, and bioinformatics.