

Deep Learning for Steel Surface Defect Detection and Applications

Speaker: Prof. Kenneth K.M. Lam

Department of Electrical and Electronic Engineering,
The Hong Kong Polytechnic University, Hong Kong

Abstract: Defect detection is an essential quality control task in manufacturing and is vital for rail-track reliability. If manufacturers do not appropriately address defects in a timely manner, the quality and lifespan of the steel products will be affected. Similarly, undetected defects on rail tracks can lead to fatal accidents. In this talk, we will first focus on three challenges of steel surface defect detection, which are scale variations, shape variations, and detection efficiency. To address these challenges, we will present a deep neural network, with attention mechanisms, for detecting various steel surface defects. Specifically, we consider a fused-attention framework for efficiently detecting defects. This framework applies an attention mechanism to a single balanced feature map. This can improve the accuracy and preserve the detection speed of the detection network. To handle defects with multiple scales, we present an adaptively balanced feature fusion method that can fuse features with suitable weights. It can enhance the discriminative power of the feature maps for detecting defects of different scales. Moreover, we use a fused-attention module to deal with the shape-variation issue. This module can enhance the channel and spatial feature information to perform precise localization and classification of defects with shape variations. The deep network is subsequently extended for the detection of rail-track defects. Finally, we will demonstrate real-world applications of this defect detection method in railway systems.

Biography:



Prof. Kenneth K.M. Lam received his Associateship in Electronic Engineering with distinction from the Hong Kong Polytechnic University in 1986, the M.Sc. degree in communication engineering from the Department of Electrical Engineering, Imperial, London, U.K., in 1987, and the Ph.D. degree from the Department of Electrical Engineering, The University of Sydney, Australia, in 1996. He joined the Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, as an Assistant Professor in 1996. He became an Associate Professor in 1999 and has been a Professor since 2010. His current research interests include image and video processing, computer vision, and human face analysis. He received an Honorable Mention of the Annual Pattern Recognition Society Award in 2004.

Prof. Lam has been actively involved in professional activities. After chairing the IEEE SPS Hong Kong Chapter (2006-2008), he served as IEEE SPS Director-Student Services (2012-2014), APSIPA-Member Relations and Development (2014-2017), IEEE SPS Director-Membership Services (2015-2017), and APSIPA VP-Publications (2018-2021). Currently, he is the IEEE SPS Vice President- Membership and a Member-at-Large of the APSIPA Board of Governors. He was an Associate Editor of IEEE Trans. on Image Processing (2009-2014) and Digital Signal Processing (2014-2018), an Editor of HKIE Transactions (2013-2018), and an Area Editor of the

IEEE Signal Processing Magazine (2015-2017). Currently, he is an Associate Editor of EURASIP International Journal on Image and Video Processing and a Senior Editorial Board member of APSIPA Transactions on Signal and Information Processing. His current research interests include image and video processing, computer vision, and human face analysis and recognition.