

When 5G Meets with Big IoT Data for Coordinated Mining of 3D World

Abstract: Thanks to the ultra-reliable low-latency communication (URLLC) capability of the emergent 5G mobile networks, the information derived from the roadside static surveillance or on-board moving IoT sensors (e.g., video cameras, Radars and Lidars), which can be jointly explored by the mobile edge computing (MEC) and real-time shared by all the local connected users for various smart city applications. To achieve this goal of coordinated mining of different modalities of IoT data, all of the detected/segmented and tracked human/vehicle objects need to be 3D localized in the world coordinate for effective 3D understanding of local dynamic evolutions. In this talk I will mainly talk about some challenges and potential solutions, more specifically, a robust tracking and 3D localization of detected objects, from either static/moving monocular video cameras, is proposed based on a variant of the Cascade R-CNN detector trained with triplet loss to obtain the accurate localization and the corresponding discriminating identity-aware features for tracking association, even with long-term occlusion, of each detected object in one-shot. When the cameras fail to reliably achieve these tasks due to poor lighting or adverse weather conditions, Radars and Lidars can offer more robust localization than the monocular cameras. However, the semantic information provided by the radio or point cloud data is limited and difficult to extract. In this talk, I will also introduce a radio object detection network (RODNet) to detect objects purely from radio signals captured by Radar based on an innovative cross-modal supervision framework, which utilizes the rich information extracted from the camera to teach object detection for Radar without tedious and laborious human labelling of ground truth on the Radar signals. Moreover, to compensate the disadvantage of Lidar detection on far-away small objects, effective integration of Lidar based detections, along with 2D object detections and 3D localization from monocular images based on 3D tracking associations, to achieve superior tracking and 3D localization performance. Finally, an efficient 3D human pose estimation for action description of detected human in natural monocular videos is also presented for finer-grained 3D scene understanding for smart city applications.



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Dr. Jenq-Neng Hwang received the BS and MS degrees, both in electrical engineering from the National Taiwan University, Taipei, Taiwan, in 1981 and 1983 separately. He then received his Ph.D. degree from the University of Southern California. In the summer of 1989, Dr. Hwang joined the Department of Electrical and Computer Engineering (ECE) of the University of Washington in Seattle, where he has been promoted to Full Professor since 1999. He served as the Associate Chair for Research from 2003 to 2005, and from 2011-2015. He also served as the Associate Chair for Global Affairs from 2015-2020. He is the founder and co-director of the Information Processing Lab., which has won CVPR AI City Challenges awards in the past years. He has written more than 380 journal, conference papers and book chapters in the areas of machine learning, multimedia signal processing, and multimedia system integration and networking, including an authored textbook on "Multimedia Networking: from Theory to Practice," published by Cambridge University Press. Dr. Hwang has close working relationship with the industry on multimedia signal processing and multimedia networking.

Dr. Hwang received the 1995 IEEE Signal Processing Society's Best Journal Paper Award. He is a founding member of Multimedia Signal Processing Technical Committee of IEEE Signal Processing Society and was the Society's representative to IEEE Neural Network Council from 1996 to 2000. He is currently a member of Multimedia Technical Committee (MMTC) of IEEE Communication Society and also a member of Multimedia Signal Processing Technical Committee (MMSP TC) of IEEE Signal Processing Society. He served as associate editors for IEEE T-SP, T-NN and T-CSVT, T-IP and Signal Processing Magazine (SPM). He is currently on the editorial board of ZTE Communications, ETRI, IJDMB and JSPS journals. He served as the Program Co-Chair of IEEE ICME 2016 and was the Program Co-Chairs of ICASSP 1998 and ISCAS 2009. Dr. Hwang is a fellow of IEEE since 2001.