Making the Invisible Visible: Towards High-Quality, AI-Powered THz Computational Imaging

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DATE 15 May, 2023 (Mon)
TIME 4:30 PM - 5:30 PM
VENUE Y6405, CS Seminar Room, 6/F., Yellow Zone, Yeung Kin Man Academic Building, City University of Hong Kong, Kowloon Tong, Hong Kong

ABSTRACT

Terahertz (THz) computational imaging has recently attracted significant attention thanks to its non-invasive, non-destructive, non-ionizing, material-classification, and ultra-fast nature for 3D object exploration and inspection. However, its strong water absorption nature and low noise tolerance lead to undesired blurs and degradations of reconstructed THz images. The performances of existing methods are highly constrained by the diffraction-limited THz signals. In this talk, we will introduce the characteristics of THz imaging and its applications. We will also show how to break the limitations of THz imaging with the aid of rich spectral amplitude and phase information carried in prominent THz frequencies (i.e., the water absorption profile of THz signal) for THz image restoration. To this end, we propose a novel physics-guided deep neural network model to fuse such multi-spectral features of THz images for effective restoration. Furthermore, we experimentally construct a THz time-domain spectroscopy system covering a broad frequency range from 0.1 THz to 4 THz for building up THz computed tomography database of hidden 3D objects.

BIOGRAPHY

Prof. Chia-Wen Lin is currently a Professor with the Department of Electrical Engineering, National Tsing Hua University (NTHU), Taiwan. He also serves as Deputy Director of the AI Research Center and director of Multimedia Technology Research Center of NTHU. He was Visiting Professor with Nagoya University, Nagoya, Japan in 2019 and National Institute of Informatics, Tokyo, Japan in 2015. His research interests include image/video processing, computer vision, and machine learning. Dr. Lin is an IEEE Fellow, and has been serving on IEEE Circuits and Systems Society (CASS) Fellow Evaluating Committee since 2021. He is also serving as IEEE CASS BoG Members-at-Large during 2022~2024. He was Steering Committee Chair of IEEE ICME (2020~2021), IEEE CASS Distinguished Lecturer (2018~2019), and President of the Chinese Image Processing and Pattern Recognition Association, Taiwan (2019~2020). He has served as Associate Editor of IEEE Transactions on Image Processing, IEEE Transactions on Multimedia, IEEE Transactions on Circuits and Systems for Video Technology, and IEEE Multimedia. He was Chair of the Multimedia Systems and Applications Technical Committee of the IEEE CASS. He served as TPC Chair of IEEE ICME in 2010 and IEEE ICIP in 2019, and the Conference Chair of IEEE VCIP in 2018. His papers won the Best Paper Award of IEEE VCIP 2015, and the Young Investigator Award of VCIP 2005.

All are welcome!

In case of questions, please contact Dr. Shiqi Wang at shiqwang@cityu.edu.hk, or visit the CS Departmental Seminar Web at https://www.cs.cityu.edu.hk/events/cs-seminars/recent-cs-colloquiums.