Reservoir Computing Based Equalization for Radio over Fiber System

Jingwei Li‡, Yibo Lyu‡, Xu Li‡, Tianxiang Wang‡, Xiaowen Dong‡

‡ Central Research Institute, Huawei Co. LTD

lijingwei10@huawei.com, lvyibo@huawei.com, lixu11@huawei.com, wangtianxiang@huawei.com, xiaowen.dong@huawei.com

Corresponding Author: xiaowen.dong@huawei.com

Abstract—Reservoir computing (RC) attracts much attention in many time-series tasks due to its nonlinear mapping capability from the lower space to the higher space and the dynamic memory ability. With conceptual simplicity and computation cheapness, RC is also suitable for hardware implementation. In this paper, the RC is applied to perform the signal equalization for wavelength division multiplexing (WDM) radio over fiber (RoF) system to compensate the distortion caused by the nonlinearity of single wavelength and the interference between multiple wavelengths. Simulation results show that RC with 500 reservoir nodes can enhance the adjacent channel power ratio (ACPR) of the WDMRoF system from 6 dB to 9 dB after equalization, where the ACPR can be further improved by simply increasing the reservoir size.

Keyword— Reservoir Computing, Equalization, Wavelength Division Multiplexing, RoF, Distortion, Adjacent Channel Power Ratio.

Jingwei Li received the B.Eng. degree in optical information engineering from Chongqing University, China, in 2014, the Ph.D. degree in optical engineering from College of Optical Science and Engineering, Zhejiang University, China, in 2019. He had been a visiting scholar in Caltech Optical Imaging Laboratory, California Institute of Technology from October 2017 to October 2018. He has authored 10 papers in refereed international journals. Since 2019, he worked as a senior engineer in Huawei Co. LTD. His current research interests include machine learning and optical computing.

Yibo Lyu received the M.Sc. degree in information and signal processing from the Chongqing University of Posts and Telecommunications in 2011 and the Ph.D. degree in circuits and systems from Xiamen University in 2016. His research interests include channel coding, joint source and channel coding, chaotic communications and nonlinear compensation. His current research projects include the modulation and coding methods for wireless optical communication system and the signal processing algorithms for radio over fiber system.

Xu Li received the B.S. and Ph.D. degrees in electrical and electronics engineering from the University of Science and Technology of China (USTC), in 2010 and 2015, respectively. From 2013 to 2014, he was a visiting Ph.D. student at Department of Electrical Engineering and Computer Science, Northwestern University in the U.S.. Since 2015, he is a wireless senior engineer in the Central Research Institute. 2012 Laboratory of Huawei Tech. Co. Ltd. His research involves various architectures of radio access network in 5G, especially end to end network slicing. He has a rich wireless research experience including ultra-wide band (UWB) chips, interference alignment, relay networks, stochastic geometry and public safety wireless broadband networks. His current research topics include microwave wireless communication, radio over fiber communication and optical wireless communication.

Tianxiang Wang is a Senior Technologist in Wireless Technology Lab of Huawei Co. LTD. His research interests include optoelectronic integration for next generation mobile communication system and field system verification.
Xiaowen Dong received the B.E. degree in electronic engineering from Southwest Jiaotong University, Chengdu, China, in 2005, the M.E. degree (with First Class Honors) in electronic engineering from the National University of Ireland, Maynooth, Ireland, in October 2008 and the Ph.D. degree in green optical networks from University of Leeds, Leeds, U.K, in March 2013. He received the Cater Prize (the best Ph.D. thesis award) in July 2013 and the Premium Award for Best Paper IET Optoelectronics in July 2016. From 2005 to 2007, he was a Wireless Communication System Engineer in Wuhan Research Institute, Wuhan, China. He is currently a Senior Research Engineer in DC Technology Lab, HUAWEI Technologies CO., Ltd. His research interests include optical computing, novel data centre architectures and AI computing platforms.