Role of AI/ML in PA Linearization for Next G Wireless

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ABSTRACT

Machine learning (ML)-based digital pre-distortion (DPD) techniques have played a crucial role in the successful deployment of remote radio heads (RRHs) and radio units (RUs) [1]. These techniques enhance radio frequency (RF) line-up efficiency while meeting the stringent 3GPP linearity requirements. Considering the environmental impact of radio access technologies alongside traditional performance metrics that have driven the evolution of 4G and 5G systems, it's essential to recognize that wireless infrastructure consumes a significant portion of energy used by communication service providers [2]. In this presentation, we will explore an underlying technology: integrated and adaptive DPD. This technology promotes more sustainable operations for next-generation wireless systems by reducing the carbon footprint. It achieves this by lowering energy consumption and eliminating power waste resulting from inter-module data exchanges. As artificial intelligence (AL) permeates all layers of wireless communications, we will compare advanced artificial neural network (ANN) models with traditional Volterra-based models, followed by experimental results including key performance indicators. Additionally, we'll discuss the sequential cascading of Volterra-based models, inspired by AI/ML techniques to address non-convex optimization problems. The study's findings will illuminate the modeling capabilities of state-of-the-art DPD research and provide insights into future directions from the industrial perspective.

[1] K. Chuang et al., "Radio challenges, architectures, and design considerations for wireless infrastructure: Creating the core technologies that connect people around the world," *IEEE Microw. Mag.*, vol. 23, no. 12, pp. 42–59, Dec. 2022, doi: 10.1109/MMM.2022.3203925.

[2] K. Chuang et al., "Towards sustainable networks: Attacking energy consumption in wireless infrastructure with novel technologies," *IEEE Microw. Mag.*, vol. 24, no. 12, pp. 44-59, Dec. 2023, doi: 10.1109/MMM.2023.3314319.