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# Machine Learning Techniques for Efficient PAPR Reduction: A Theoretical Perspective

Punit Kumar Upmanyu
Assistant Professor
MIT, Ujjain, India
upmanyu.punit20@gmail.com

*Abstract* –**The requirement for high data rates in current wireless communication systems has led to the large deployment of OFDM technique in 4G LTE networks and is anticipated to continue in future 5G and 6G networks. Although there are many benefits of the OFDM, the Peak-to-Average Power Ratio (PAPR) problem is a severe drawback to OFDM. High PAPR causes inefficiency of power amplifiers, signal distortion, spectral regrowth that degrades the performance of system. The most popular ones are through Clipping and Filtering, Partial Transmit Sequence (PTS), and more recently, Selected Mapping (SLM). But they frequently encounter trade-offs in signal quality, computational complexity, and performance efficiency. Due to these constraints, adaptive and efficient methods are in demand for PAPR mitigation in OFDM systems, and machine learning (ML) has emerged as a promising approach. In this work, a theoretical overview of Machine Learning-based methods applied to PAPR mitigation is provided, and several neural network models including Artificial Neural Networks (ANN), Deep Neural Network (DNN), and Reinforcement Learning (RL) are discussed based on their benefits and limitations. The paper also discusses future avenues for research on hybrid models, federated learning, and real-time optimization techniques for 5G and beyond. ML can be utilized to further augment PAPR reduction, leading to advanced versatile and adaptive communication systems in emerging wireless technologies.**

*Keywords* – **ANN, DNN, Machine Learning, OFDM, PAPR, PTS, Reinforcement Learning, SLM, etc.**