

Research on the application of deep learning in beam management in 5G NR access networks

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Abstract: This study investigates the application of deep learning for beam management in 5G New Radio (NR) access networks. As 5G NR operates in high-frequency millimeter-wave bands, precise beamforming is essential to overcome severe path loss and ensure reliable connectivity. However, conventional beam management procedures, which rely on exhaustive beam sweeping, introduce significant latency and overhead, particularly in high-mobility scenarios. This research proposes a deep learning-based framework to predict optimal beam pairs and streamline beam tracking. By leveraging historical channel state information and user mobility patterns, the model reduces the need for frequent beam sweeps while maintaining high link quality. Simulation results demonstrate that the proposed approach significantly decreases beam management latency and signaling overhead compared to traditional methods. Furthermore, the model exhibits robust performance under varying user velocities and channel conditions. These findings highlight the potential of deep learning to enhance the efficiency and adaptability of beam management in 5G NR, contributing to improved network performance and user experience in next-generation wireless systems.

Keywords: deep learning, beam management, 5G NR, access network