
Joint Uplink Radio Access and Fronthaul Reception Using MMSE Estimation

Abstract:

In cloud-based radio access networks, remote radio units and central baseband units are connected by fronthaul links, which are commonly assumed to be error-free. However, especially for wireless millimeter wave fronthaul links, this might be challenging to achieve, as they face a more unreliable environment than the conventionally used fiber links. In this paper, we hence aim to mitigate the impact of imperfect fronthaul links. For this, we propose the concept of joint radio access and fronthaul reception, which considers to recover the transmitted messages correctly at the centralized baseband unit, rather than to ensure a nearly perfect fronthaul transmission in between. Based on the Bayesian minimum mean square error criterion, we develop a joint access and fronthaul estimation scheme that can be utilized for various signals transported over the fronthaul, including in-phase/quadrature phase (I/Q) samples, soft-bits, synchronization, and reference signals. In addition, we develop an approximated variant of the scheme to reduced complexity, and an iterative extension to further improve the performance. We demonstrate that our scheme can operate under less reliable fronthaul than conventional approaches by numerical simulation for different signals, and show that our method can be implemented in a parallel architecture to achieve a reasonable computational complexity.