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Optimization of Spectral Efficiency in Cell-Free massive MIMO Systems Using Deep Neural Networks

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Abstract

Cellular communication is a widely used technology in the world where the coverage area is divided into multiple cells. Interference is one of the most important challenges in cellular networks which causes problems by reducing the quality of the service. Cell-Free (CF) massive multiple-input multiple-output (MIMO) is a novel technolgy in which a large number of distributed access points (APs) are concurrently serving a small number of user equipment (UE). CF network can be an alternative technology to cellular networks for reducing interference. A challenging task in a CF network is scalability, where although the number of UEs tends to infinity, the computational complexity must remain finite in each AP or UE. In this paper, we provide two architectures of Dense fully connected neural network (Dense_Net) and 1D convolution neural network (Conv_Net) to be implemented in different cases in terms of the number of antennas in each AP/UE and the method for the combining vector. The Dense_Net outperforms the Conv_Net in all the cases. For instance, in the first case it has a %62.87 improvement in terms of loss. The results show that our proposed method performs better in terms of obtaining optimal values for spectral efficiency (SE).

Keywords: Cell-Free Massive MIMO, scalability, spectrum efficiency, deep learning, convolutional neural network