

Abstract

Mobile broadband traffic has expanded dramatically in recent decades, requiring capacity. Today, Cellular User Equipment (CEU) with various services is quickly expanding and developing. A communication system that can provide various services by using limited resources is required to overcome this issue.

Device-to-Device (D2D) communication systems are what these terms refer to. Although the capability of D2D underlaying to reuse resources held by CUE, interference remains a major issue. Furthermore, D2D is frequently used on wearable devices with limited power sources, such as batteries. As a result, the problem formulation of this thesis is to solve the interference issue by using a power allocation scheme that maximizes the energy efficiency of the system.

To provide optimum power allocation, iterative methods such as Convex Approximation (CA)-based algorithm need to run multiple iterations. Therefore, Convolution Neural Network (CNN), as part of Deep Learning (DL), is utilized to replace (CA)-based algorithm for generating power allocation policies. However, the conventional method of CNN has limitations in accepting arbitrary input size. Accordingly, to the limitation of CNN, the combination of CNN with Spatial Pyramid Pooling (SPP) to overcome the limitation of the input size of conventional CNN.

In this thesis, the combination of CNN with Spatial Pyramid Pooling (CNN-SPP) is used to solve problem formulation in providing power control policies. Previously, CNN-SPP methods had to be trained using multiple datasets. The dataset used in this thesis consists of channel gain as input and power allocation policies as output, obtained through Convex Approximation (CA) based algorithm.

Through simulation results, CNN-SPP can achieve similar performance to the (CA) based algorithms in terms of data rate and energy efficiency up to 95% under one millisecond. Furthermore, the CNN-SPP method can overcome the limitation of the input size of the conventional CNN method. However, CNN is more reliable in terms of MSE than CNN-SPP.

Keywords: Device-to-Device underlaying, Energy efficiency, power control, Convolutional Neural Network, Spatial Pyramid Pooling Layer.