Machine Learning Assisted Cell Association for Ultra Dense Communication Network

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Introduction

In the future ultra dense heterogeneous networks will form the infrastructure of 5G. Our aim is find unique solutions for Signal to Noise Interference Ratio (SINR) values and support this solutions with computer simulations.
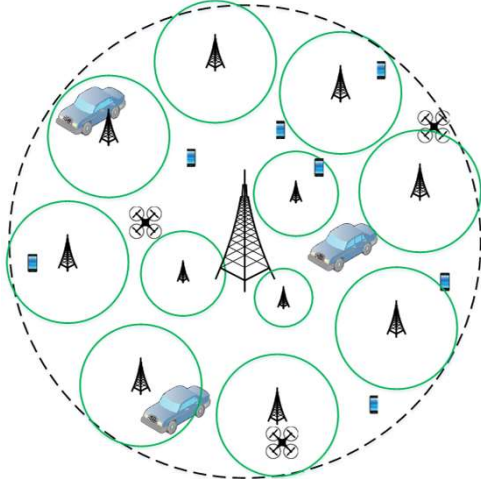

Figure 1: Ultra Dense Heterogeneous Network

Specifications and Design Requirements

Our problem is :

Maximize

$$\sum_{i=1}^{N}\left(x_{i,1}SINR_{i,1}^{c} + x_{i,2}SINR_{i,2}^{c}\right),$$

Limitations

$$x_{i,k} \in \{0,1\}, \qquad \forall i,k,$$

$$\sum_{k=1}^{2}x_{i,k} \leq 1, \qquad \forall i,$$

$$\sum_{i=1}^{N}\sum_{k=1}^{2}x_{i,k} \leq N.$$

$$\sum_{i=1}^{N}x_{i,2}\left|h_{i,1}\right|^{2}P_{UE} \leq Q_{1},$$

$$\sum_{i=1}^{N}x_{i,1}\left|h_{i,2}\right|^{2}P_{UE} \leq Q_{2}.$$

Our system design is two cell heterogeneous network system with multiple users.
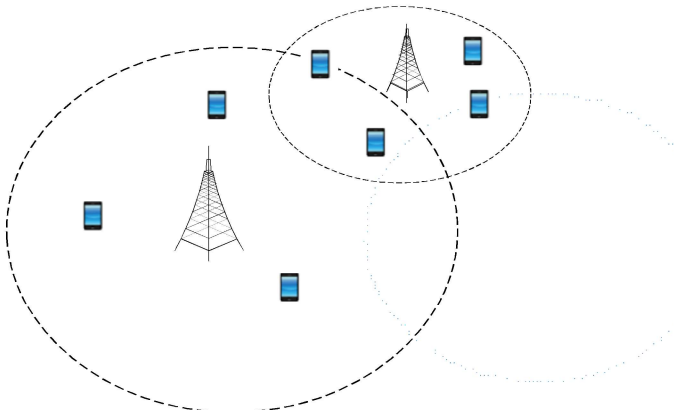

Figure 2: Two cell heterogeneous network system model with multiple users.

Solution Methodology

Our approach to the problem is first using brute force solution find the optimum connection for the system after that, create a machine learning algorithm that predict the connections of the system with respect to solution with minimal error.

Results and Discussion

Our approach to the problem is first using brute force solution find the optimum connection for the system after that, create a machine learning algorithm that predict the connections of the system with respect to solution with minimal error.

Our brute force solution shows us for SINR values best solution is make connection with strongest signal and don't connect others.

Some results of ML algorithm predictions with different number of users (yellow dots are wrong predictions):

5 users   6 users   7 users
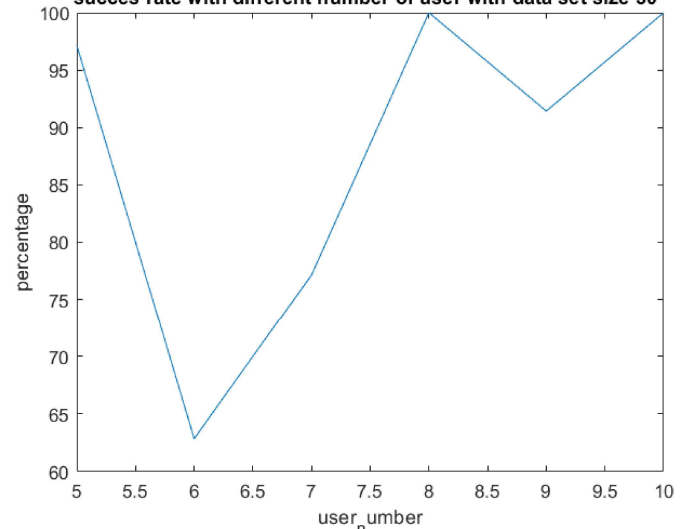
8 users   9 users   10 users
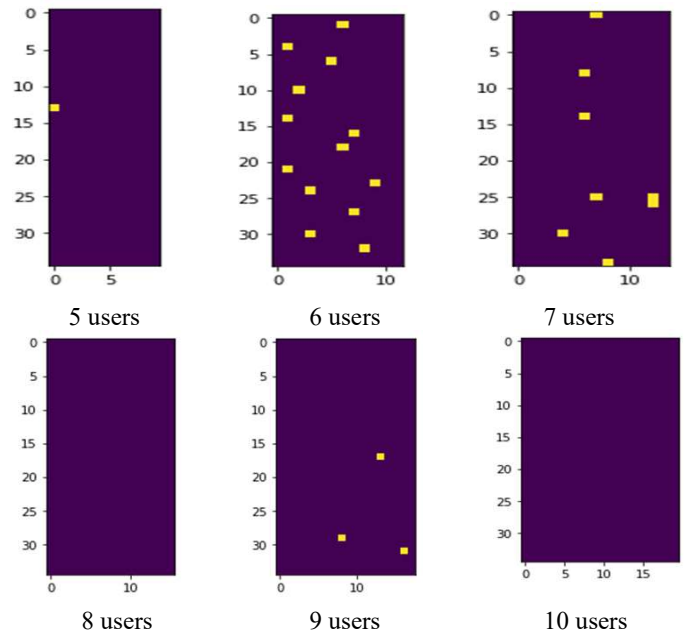
Figure 3: Success Rate of The Algorithm with Different Number of Users