**Simulation Parameters and Dataset Generation Overview**

In the simulated factory environment, a multitude of strategically deployed short-range cells forms the backbone of robotic systems, production modules, conveyors, and other industrial machinery. These cells, designated as In-factory subnetworks (InF-S), are comprised of an access point (AP) serving one or more devices within the subnetwork. Each device is allocated orthogonal resources, with the primary challenge being inter-cell interference affecting spectral efficiency. For simplicity, we assume each subnetwork serves a single device, utilizing the entire available bandwidth for its transmissions.

Within each InF-S, the AP is positioned at the center of a circular coverage area with a radius ( $R$ ), and a device is located at a distance ( $d$ ) with a minimum proximity of ($d_{min}$) meters to the AP. Our system accommodates four available channels for wireless communication.

The wireless communication channel model adheres to 3rd Generation Partnership Project (3GPP) specifications for InF scenarios, encompassing path-loss, shadowing, and small-scale fading. Small-scale fading, assumed to be Rayleigh distributed, exhibits flat fading. For the path-loss model, we consider a dense clutter and low base station height InF scenario, calculating losses based on carrier frequency and the distance between nodes. Probability of a clear Line of Sight (LoS) is determined by distance, size of clutter elements, and clutter density.

Subnetwork links feature correlated shadowing, wherein a source of shadowing affects multiple links simultaneously. Deployment area shadowing is represented in a grid with a stationary and isotropic Gaussian random field characterized by zero mean and exponentially decaying spatial correlation.

The deployment density is specified as 50,000 subnetworks per square kilometer, with a minimum separation distance ($d_{min} = 2$) meters between subnetworks. InF-S are modeled by circular coverage areas with a radius of($d_r = 1$) meter. The minimum distance between APs and devices is 0.8 meters. Shadowing standard deviation is 7.2. Clutter element size is 2 meters, and clutter density is 60 %.

For dataset generation, 20 subnetworks are deployed in a factory with a $20 \times 20(m^2)$ are, characterized by dense clutter. Radio resources are sparse, and thus, the number of frequency channels is set to ( $K = 4$ ), compelling subnetworks to share limited resources. Radio propagation parameters (carrier frequency ($f_c = 6$) GHz, channel bandwidth ( $BW = 10$ ) MHz, transmit powers ($p = 0$) dBm, noise figure ( $NF = 5$ ) dB, and decorrelation distance ($d_c = 5$) meters) are fixed for all simulation results, detailed in the table below:

| **Parameter** | **Value** |
|---|---|
| Factory area, $L \times L$ | 20 m×20 m |
| Number of subnetworks, $N$ | 20 |
| Number of sub-bands, $K$ | 4 |
| Subnetwork radius, $R$ | 1 m |
| Number of devices per subnetwork, $J$ | 1 |
| Minimum distance between APs | 2 m |
| device to APs minimum distance, $d_{min}$ | 0.8 |
| Shadowing standard deviation, $\lambda$ | 7.2 dB |
| DL clutter density, $r$, clutter size, $d_s$ | 0.6, 2 |
| De-correlation distance, $d_c$ | 5 m |
| Transmit power, P | 0 dBm |
| Bandwidth, $B$ | 40 MHz |
| Center frequency, $f_c$ | 6 GHz |
| Noise figure, $NF$ | 5 dB |

We generated $n_{samp} = 200{,}000$, snapshots of the subnetwork deployment and saved the location (x and y) of subnetworks and channel gain between subnetworks. Therefore, we have two files with the numpy format: Channel_matrix_gain.npy and Location_mat.npy. The dimension of the first one is $n_{samp} \times K \times N \times N$ and the second one has the dimension of $n_{samp} \times N \times 2$. The Python script for generating new datasets with various parameters is available.