OPEN LAB

Hardware/Software Required:

Hardware: Desktop/ Notebook Computer
Software Tool: MATLAB R2017a, Python 3.6.3, Microsoft Visual Studio 2017

Syndicate A:

Recently machine learning has gained much popularity in the field of wireless communications & networking and it is widely used now a day in developing state of the art Internet of Things (IoT) based sensor nets. An IoT network consists of sensor nodes where each node can transmit or receive data from the adjacent nodes through one or more channels. Each channel within an IoT network can be efficiency utilized if the network is able to sense candidate channel's time/ spectral characteristics and decide whether to use its time slots or spectral bandwidth in order to achieve maximum data transmission. Considering this, you guys need to devise a decision support system for the automated selection of channel time/ spectral characteristics for efficiently transmitting multiuser data.

Network Setup:

Initialize number of sender nodes within a network (use a random function for this)

For each user, generate the dummy message signal using the expression given below:

$$m_i = 2\sin(100\pi n_i)$$

where m_i denotes the message signal for i^{th} user and n_i denotes the message length in samples and it varies from user to user (again use random function for this)

Modulate it with the cosine carrier signal of 3 kHz frequency using double sideband suppressed carrier (DSB-SC) bandpass modulation (if it seems freakingly odd to you, then google it. Although it's quite simple)

Model the 5 MHz channel using Addition White Gaussian Noise (AWGN) with the random signal to noise ratio (SNR) in between 0 to 1. The higher value of SNR will generate higher signal power and minimum distortion.

Now deploy a decision support system (DSS) of your choice (without any built-in function) to decide whether to use channel time or spectral bandwidth based upon number of users and the length of each user packet within an IoT network. To train the DSS, the training dataset has been provided to you with known labels. You can use an ensemble of multiple classifiers as well.

After you achieve the accuracy of 90% or above on the training dataset, use that trained model to partition channel for multiuser data transmission.

If the DSS says to partition it w.r.t time, find the channel capacity and divide it on number of users to send each user data in one iteration. Find the total time to transmit all the multiuser data.

Else if the DSS says to partition it w.r.t frequency, take the Fast Fourier Transform (FFT) of user messages (compute magnitude spectra only) and divide the channel bandwidth with respect to number of users to allocate the equal portion of channel bandwidth to all users. Repeat the process until all user data has not been transmitted and after that find the total time to transmit all the multiuser data.