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import numpy as np
import scipy as sy
import scipy.fftpack as syfp
import matplotlib.pyplot as plt

values = np.genfromtxt("D:\\Desktop\\UCI HAR Dataset\\train\\inertial_signals\\body_acc_x_train.csv", delimiter = ",")
labels = np.genfromtxt("D:\\Desktop\\UCI HAR Dataset\\train\\y_train.txt", delimiter = "\n")

labels_dic = { # create a dictionary with the label numbers and corresponding activities
    1: "Walking",
    2: "Walking upstairs",
    3: "Walking downstairs",
    4: "Sitting",
    5: "Standing",
    6: "Laying"
    }

def fourier_transform(num): # 1: walking, 2: walking upstairs, 3: walking downstairs
                            # 4: sitting, 5: standing, 6: laying
    array = []

    for i in range(len(labels)-1): # for every different label value in the training set...
        if labels[i] == num: #if the label is the same as the passed number...
            array.append(values[i]) # append the corresponding accel values to the blank array


    array = np.asarray(array) # convert the array to a numpy array
    array = np.ndarray.flatten(array) # flatten the array to 1-dimension

    length = len(array)
    x = sy.linspace(0.02, length*0.02, num=length) # create the x-axis markers

    yf = syfp.fft(array) # fast Fourier transform on array
    f = syfp.fftfreq(length, np.mean(np.diff(x))) # generate Fourier transform frequencies
    yf = syfp.fftshift(yf) # shift the FFT to supress 0Hz peaks

    if num <=3: # if the plot is of a walking activity (walking, upstairs, downstairs)...
        plt.figure(1) # plot on figure 1
        plt.subplot(2, 3, num) # create signal magnitude by time plot
        plt.plot(x[::200], array[::200], 'b-',) # plot values
        plt.title(labels_dic.get(num)) # label the graph with the activity type from dictionary

        plt.subplot(2, 3, num+3) # create magnitude by frequency plot
        plt.plot(abs(f), abs(yf), 'r-') # plot values
        plt.suptitle('X-direction', fontsize=16) # title the figure with the given string

    if num >= 4: # if the plot is of a non-walking activity (sitting, standing, lying)...
        plt.figure(2) # plot on figure 2
        plt.subplot(2, 3, num-3) # create signal magnitude by time plot
        plt.plot(x[::200], array[::200], 'b-',) # plot values
        plt.title(labels_dic.get(num)) # label the graph with the activity type from dictionary

        plt.subplot(2, 3, num) # create magnitude by frequency plot
        plt.plot(abs(f), abs(yf), 'r-') # plot values
        plt.suptitle('X-direction', fontsize=16) # title the figure with the given string

for i in range(1,7):
    fourier_transform(i)

plt.show()
```