

sample

June 7, 2024

1 This is a sample Jupyter Notebook

Below is an example of a code cell. Put your cursor into the cell and press Shift+Enter to execute it and select the next one, or click !here goes the icon of the corresponding button in the gutter! button. To debug a cell, press Alt+Shift+Enter, or click !here goes the icon of the corresponding button in the gutter! button.

Press Double Shift to search everywhere for classes, files, tool windows, actions, and settings.

To learn more about Jupyter Notebooks in PyCharm, see [help](#). For an overview of PyCharm, go to Help -> Learn IDE features or refer to [our documentation](#).

```
[3]: import numpy as np
import pandas as pd
import scipy

"""

Fs
k          FPAk
"""

Fs = 20000 #
Nyquist_Fs = int(Fs/2) #      (    )
Time = 1.0 #
F_1 = 2100 # 1
F_2 = 1000 # 2
F_c = 4000 #
k = 10000 #

DATA_COUNTS = 10 # sin    10
epsilon = 2 #      2

#
time_count = np.arange(0, Time, 1/Fs)
time_count_k = np.arange(0, Time, 1/k)

#
def sin_wave_gen(Freq_1, Freq_2, time_count):
```

```

sin_waves = []
for i in range(DATA_COUNTS):
    if i < DATA_COUNTS / 2:
        sin_waves.append(1.0 * np.sin(2.0 * np.pi*Freq_1*time_count) + 1.0
↪* np.sin(2.0 * np.pi*F_c*time_count))
    else:
        sin_waves.append(1.0 * np.sin(2.0 * np.pi*Freq_2*time_count) + 3.0
↪* np.sin(2.0 * np.pi*F_c*time_count))
sin_waves = np.array(sin_waves)
return sin_waves

#
sin_wave = sin_wave_gen(Freq_1=F_1, Freq_2=F_2, time_count=time_count)

#
# https://qiita.com/sumita\_v09/items/808a3f8506065639cf51
def downsampling(target_rate: int, data: np.array, fs: int) -> (np.array, int):

    #
    decimation_sampleNum = int((fs/target_rate)-1)

    # FIR
    nyqF = (target_rate)/2.0 #
    cF = (target_rate/2.0-500.)/nyqF #
    taps = 511 #
    b = scipy.signal.firwin(taps, cF) # LPF

    #
    data = scipy.signal.lfilter(b, 1, data)

    #
    down_data = []
    for i in range(0, len(data), decimation_sampleNum+1):
        down_data.append(data[i])

    return (down_data)

#
sin_wave_ds = np.array([downsampling(target_rate=k, data=sin_wave[i,:], fs=Fs)
↪for i in range(DATA_COUNTS)])

#
q_d = np.array([sin_wave_ds[:,i] - sin_wave_ds[:,i-1] for i in
↪range(1,len(time_count_k))])
q_L2 = np.array([np.linalg.norm(q_d[:,i], ord=2) for i in range(DATA_COUNTS)])
lamda = np.array(np.sqrt(k/4*Time) * q_L2 / epsilon)

```

```

#
rng = np.random.default_rng()

#
def laplace_noise_gen(k, lamda) -> np.ndarray:
    random_array = np.zeros([DATA_COUNTS, k])
    for i in range(DATA_COUNTS):
        random_array[i,:k] = rng.laplace(0, lamda[i], k)
    return random_array

#
random_array = laplace_noise_gen(k=k, lamda=lamda)

#
ffted_wave = (2/len(time_count_k)) * np.fft.fft(sin_wave_ds)
ffted_rdmarray = (2/len(time_count_k)) * np.fft.fft(random_array)

# plot
freq_range = np.fft.fftfreq(n=k, d=1/k)

#
ffted_privacy_wave = ffted_wave + ffted_rdmarray

#
privacy_wave = np.fft.ifft(ffted_privacy_wave) / (2/len(time_count_k))
privacy_wave = privacy_wave.real

```

```

[4]: from sklearn.cluster import KMeans
import matplotlib.pyplot as plt

#
fft_len = int(len(ffted_privacy_wave[0,:])/2) - 1

#      (1      2 0      )
ffted_privacy_wave_abs = np.abs(ffted_privacy_wave[:, :fft_len])
ffted_privacy_wave_mean = np.zeros((2, DATA_COUNTS))
ffted_privacy_wave_mean[0,:] = np.array([np.mean(ffted_privacy_wave_abs[i,:])
    ↪ for i in range(DATA_COUNTS)])

# k-means
cls_privacy = KMeans(n_clusters=2).fit_predict(ffted_privacy_wave_mean.T)

#
cls_privacy_pca1 = ffted_privacy_wave_mean[0:2,:].T #
df_privacy_pca = pd.DataFrame(cls_privacy_pca1,
    ↪ columns=["amplitude_mean", "zero"])
df_privacy_class = pd.DataFrame(cls_privacy, columns=["class"])

```

```

df_privacy = pd.concat([df_privacy_pca, df_privacy_class], axis=1)

#
fig, ax = plt.subplots()
for name_p, group_p in df_privacy.groupby('class'):
    ax.plot(group_p.amplitude_mean, group_p.zero, marker='o', linestyle='-',
            ms=8, label=name_p)
ax.legend()

plt.xlabel(' ')
plt.ylabel('-')
plt.show()

```

/home/jun/anaconda3/lib/python3.11/site-packages/sklearn/cluster/_kmeans.py:870:
FutureWarning: The default value of `n_init` will change from 10 to 'auto' in
1.4. Set the value of `n_init` explicitly to suppress the warning

```
warnings.warn(
Exception ignored on calling ctypes callback function: <function _ThreadPoolInfo
._find_modules_with_dl_iterate_phdr.<locals>.match_module_callback at
0x7446ac3a2f20>
```

Traceback (most recent call last):

```
File "/home/jun/anaconda3/lib/python3.11/site-packages/threadpoolctl.py", line
400, in match_module_callback
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    self._make_module_from_path(filepath)
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File "/home/jun/anaconda3/lib/python3.11/site-packages/threadpoolctl.py", line
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    module = module_class(filepath, prefix, user_api, internal_api)
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File "/home/jun/anaconda3/lib/python3.11/site-packages/threadpoolctl.py", line
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    config = get_config().split()
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/home/jun/anaconda3/lib/python3.11/site-packages/IPython/core/pylabtools.py:152:
UserWarning: Glyph 25391 (\N{CJK UNIFIED IDEOGRAPH-632F}) missing from current

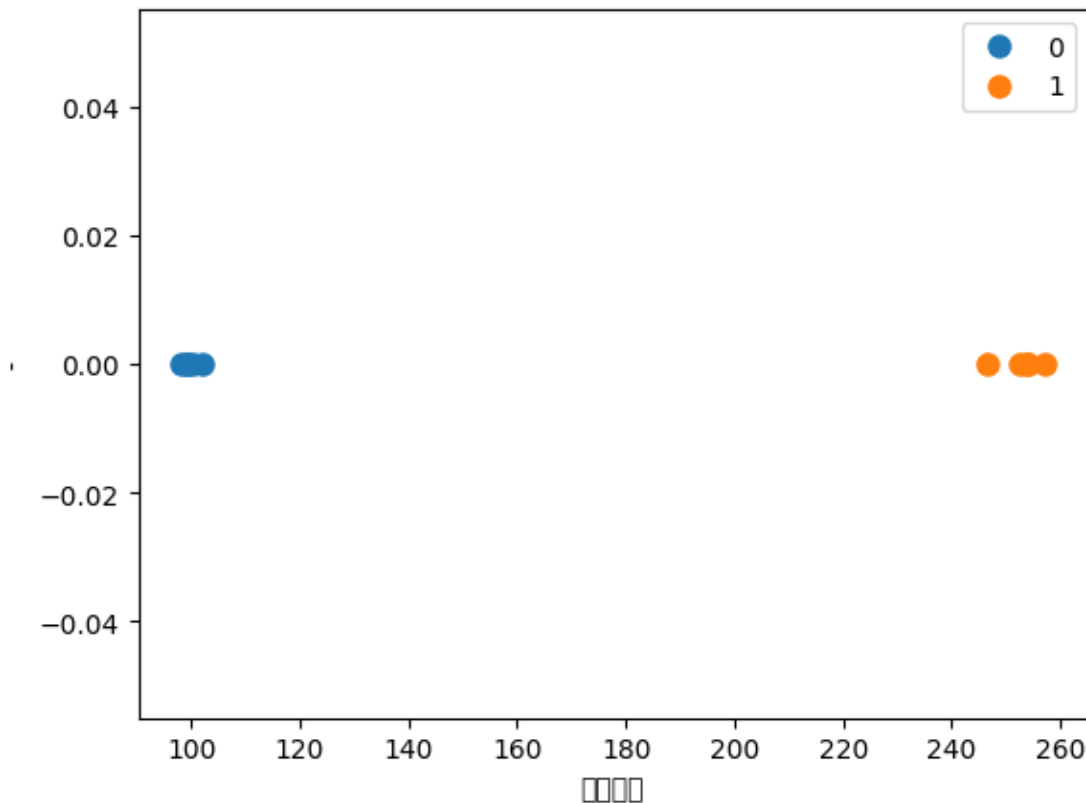
```



```

font.
fig.canvas.print_figure(bytes_io, **kw)
/home/jun/anaconda3/lib/python3.11/site-packages/IPython/core/pylabtools.py:152:
UserWarning: Glyph 24133 (\N{CJK UNIFIED IDEOGRAPH-5E45}) missing from current
font.
fig.canvas.print_figure(bytes_io, **kw)
/home/jun/anaconda3/lib/python3.11/site-packages/IPython/core/pylabtools.py:152:
UserWarning: Glyph 24179 (\N{CJK UNIFIED IDEOGRAPH-5E73}) missing from current
font.
fig.canvas.print_figure(bytes_io, **kw)
/home/jun/anaconda3/lib/python3.11/site-packages/IPython/core/pylabtools.py:152:
UserWarning: Glyph 22343 (\N{CJK UNIFIED IDEOGRAPH-5747}) missing from current
font.
fig.canvas.print_figure(bytes_io, **kw)

```



[4]: