maskingquietdemo

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1 Demo for the masking threshold in quiet

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1.0.1 Input:

Records the input from the selected microphone.

1.0.2 Output:

Displays various plots: 1. Noise Magnitude Spectrum. 2. Noise signal in the time domain. 3. Hearing Threshold in quiet.
and plays out the noise.

- **Import relevant modules**

```
In [1]: from soundfloat import sound
        import matplotlib.pyplot as plt
        import numpy as np
        from numpy.fft import fft, ifft
        import os
```

- **Defining function for processing and plotting the noise spectrum in dB domain**

```
In [2]: def noisefromdBSpectrum(spec,fs):
          #produces noise according to the dB spectrum given in spec
          #Spectrum goes from frequency 0 up to Nyquist frequency

          plt.plot(spec)
          plt.xlabel('DFT subband (lower half)')
          plt.ylabel('dB')
          plt.title('Noise Magnitude Spectrum')
          plt.show()

          specvoltage=10.0**(spec/20.0)

          #produce 40 blocks of sound:
          noise=[]
```

```
        for m in range(40):
          #Noise in the range of -1...+1, and Multiply noise with spectrum:
          noisespec=specvoltage*(np.random.rand(len(specvoltage))-0.5)*2

          #make spectrum symmetric for ifft:
          #trick: Append zeros to fill up negative frequencies in upper half of DFT, then take
          noisespec=np.concatenate((noisespec, np.zeros(len(noisespec))))
          noise=np.append(noise,np.real(ifft(noisespec,norm='ortho')))

        plt.plot(noise)
        plt.title('Produced Noise Signal in the Time Domain')
        plt.show()
        sound(noise, fs)
```

- **Running the program with variables defined as below**

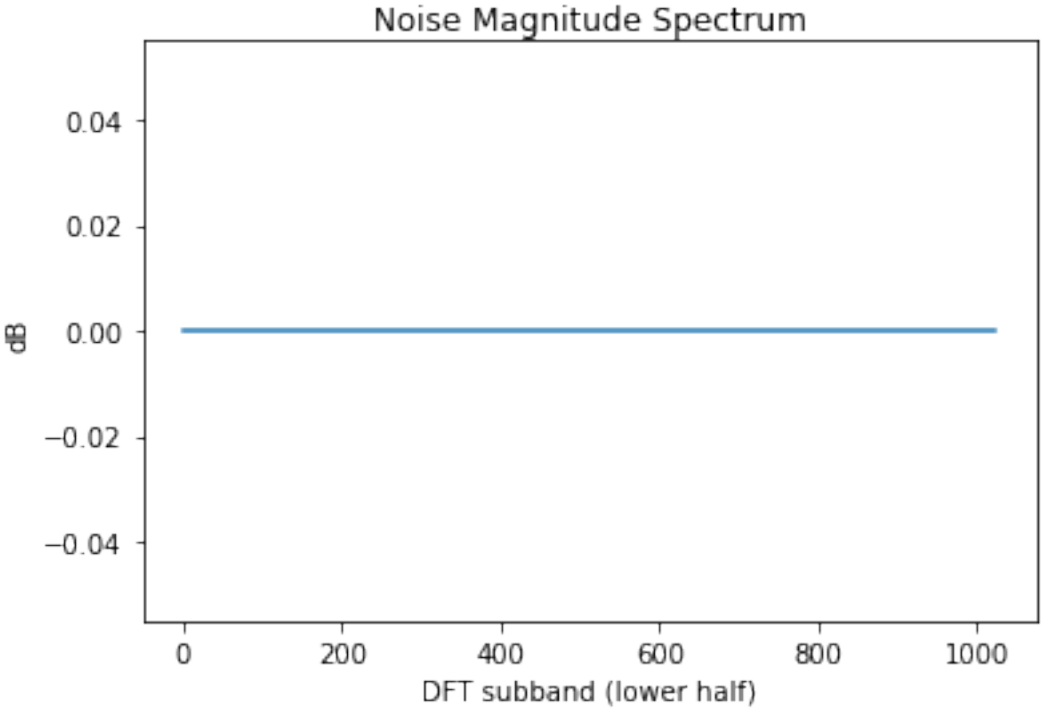
```
In [3]: if __name__ == '__main__':
            fs=32000 # sampling frequency
            N=1024 #number of subbands
```

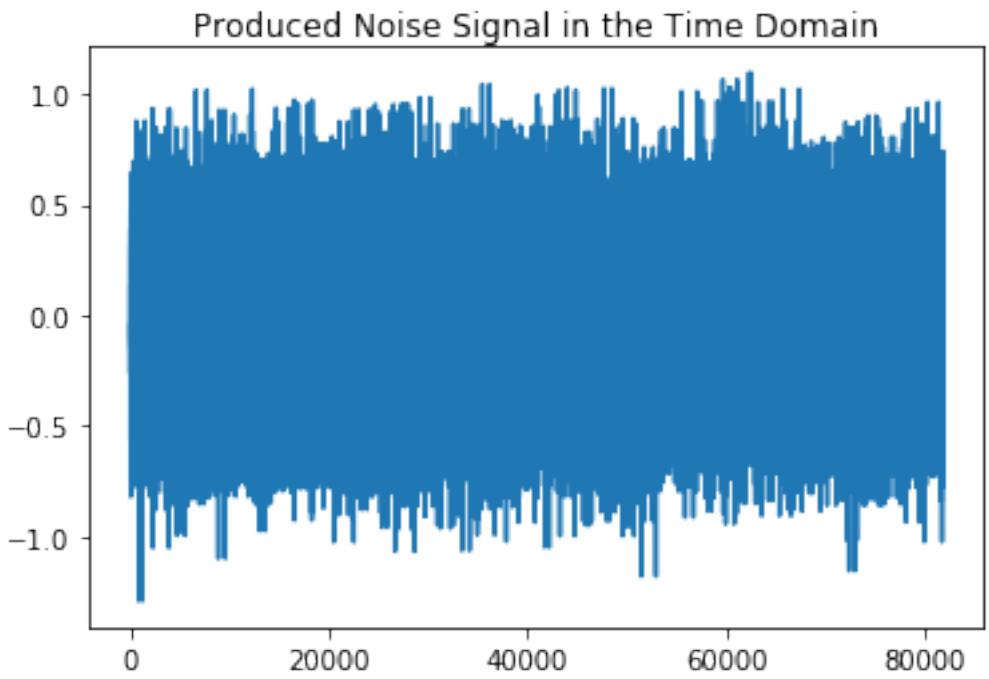
- Spectrum in dB sound level, 60 dB: speaking level:

```
In [4]:     spec=np.ones(1024)*60.0
```

- Convert to range of internal representation: Value 1 or 0 dB is full level,assume full level will result in 60 dB sound level from sound volume level:

```
In [5]:     spec=spec-60.0
            os.system('espeak -ven -s 140 '+'"Now hear white noise with flap spectrum"')
            noisefromdBSpectrum(spec,fs)
```






```
* done
```

- Masking threshold in quiet approximation, clip it to our maximum level of the internal representation:

```
In [6]:     f=np.linspace(0,fs/2,N)
```

```
In [7]:     LTQ=np.clip((3.64*(f/1000.)**-0.8 -6.5*np.exp(-0.6*(f/1000.-3.3)**2.)+1e-3*((f/1000.
```

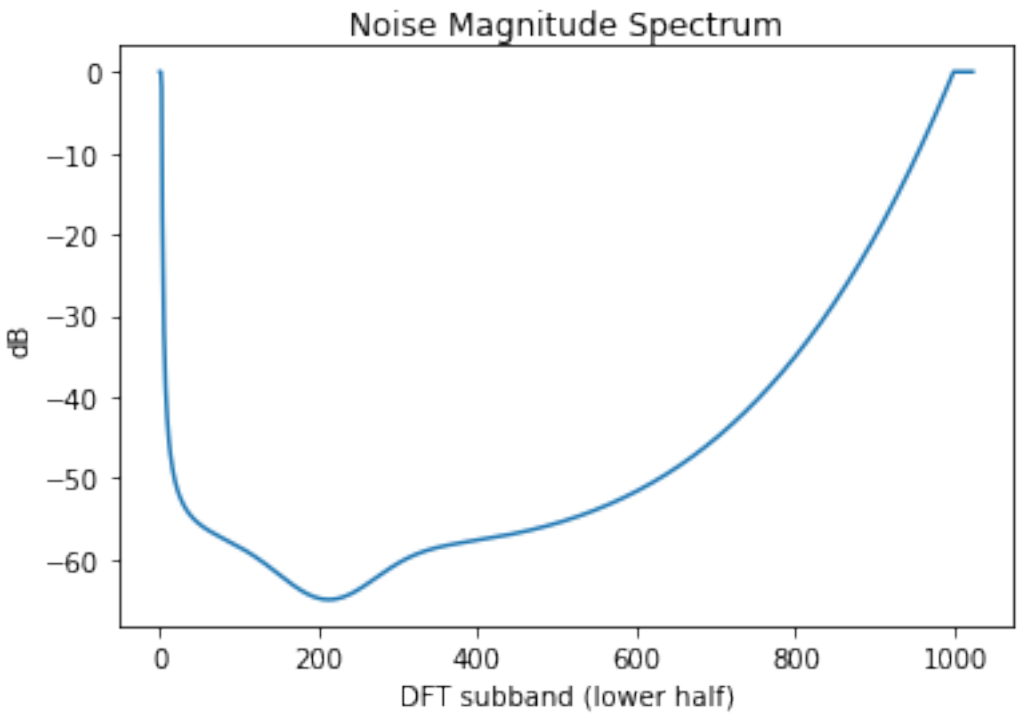
```
c:\python27\lib\site-packages\ipykernel\__main__.py:1: RuntimeWarning: divide by zero encountere
  if __name__ == '__main__':
```

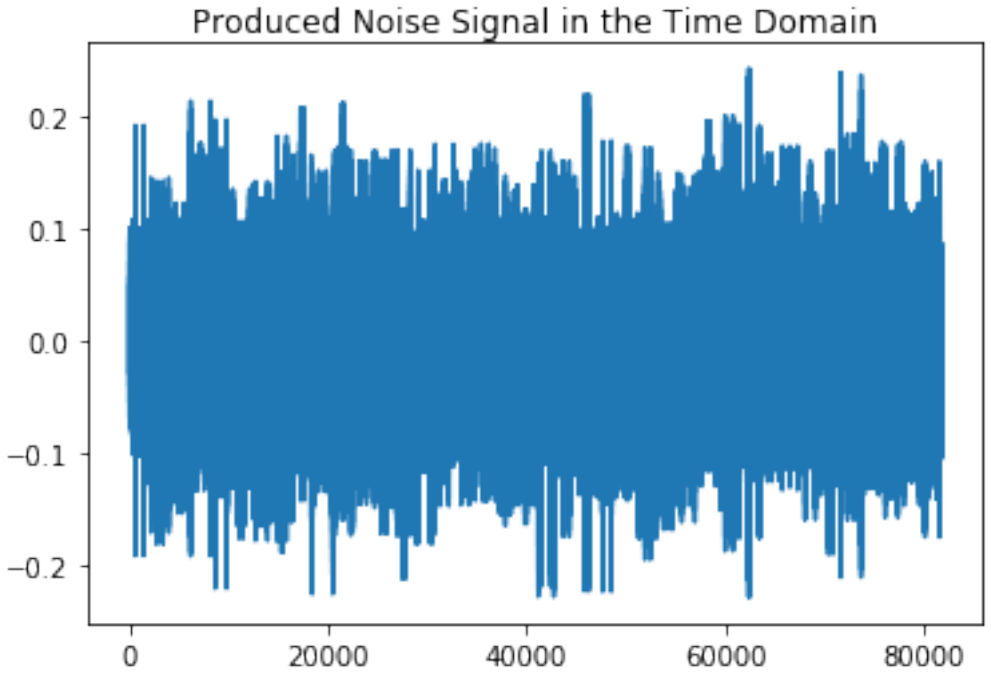
- Shift dB according to our internal representation:

```
In [8]:     LTQ=LTQ-60
```

- Play back noise shaped like the masking theshold in quiet:

```
In [9]:     os.system('espeak -ven -s 140 '+'"Now hear noise shaped like the trehsold in quiet a
            noisefromdBSpectrum(LTQ,fs)
```


Noise Magnitude Spectrum
0
−10
−20
−30
−40
−50
−60
dB
0
200
400
600
800
1000
DFT subband (lower half)


Produced Noise Signal in the Time Domain
0.2
0.1
0.0
−0.1
−0.2
0
20000
40000
60000
80000

```
* done
```

1.0.3 Note: Ignore the warnings.