Speech Signal

get_mfcc()

mfsc(y,...)

Hamming Window

```
window = get_window(win_length)
padded_window = np.pad(window,...)
```



```
y = apply_preemphasis(y,...)
frames = np.lib.stride_tricks.as_strided(y,...)
```

```
windowed_frames = padded_window * frames
```


Modulus of DFT per frame

```
D = np.abs(np.fft.rfft(windowed_frames,...))
```

$|X_1(f)|^2$ $|X_2(f)|^2$ $|X_3(f)|^2$

Mel Spectrogram

```
filterbank  = get_filterbank()
mf = np.dot(filterbank, D)
```

Mel-scaled power spectrogram

mfsc2mfcc(S,...)

Discrete Cosine Transform (DCF)

```
M = scipy.fftpack.dct(S,...)[:n_mfcc]
```

```
M -= M.mean(...)
M /= M.std(...)
```

```
M *= lifter_window
```

MFCC coefficients