

Relatório – ST10: Extração de Características de Curto Prazo Energia e ZCR

1. Enunciado

Today's Short Test (ST10): Consider the hypothetical speech signal segment $s[n] = \{1, 2, -3, 3, -2, 1, -1, -1, 4, 5, -5, 4\}$, sampled at 8000 samples per second. Assume that a sliding rectangular window $w[n]$ traverses it in order to extract features for inclusion in the feature vector $f[n]$, covering 0.25ms at each placement, with 50% overlap between consecutive windows. What is the length of $f[n]$? What are the values in $f[n]$, considering the raw energy as being the feature used? What if ZCR is considered instead of energy?

2. Código Python

```
import numpy as np

s = np.array([1, 2, -3, 3, -2, 1, -1, -1, 4, 5, -5, 4])
Fs = 8000

window_duration_s = 0.00025
overlap = 0.50

L = int(window_duration_s * Fs)
hop_size = int(L * (1 - overlap))

f_energy = []
f_zcr = []

num_windows = int(np.floor((len(s) - L) / hop_size)) + 1

for i in range(num_windows):
    start_index = i * hop_size
    end_index = start_index + L
    window = s[start_index:end_index]

    energy = np.sum(window**2)
    f_energy.append(energy)

    zcr = 0.5 * np.abs(np.sign(window[0]) - np.sign(window[1]))
    f_zcr.append(int(zcr))

print("--- Resolução do Exercício ST10 ---")
print(f"\n1. Comprimento do vetor de características f[n]: {len(f_energy)}")
print(f"\n2. Valores de f[n] para Energia:")
```

```
print(f"    f_energia[n] = {f_energy}")
print(f"\n3. Valores de f[n] para ZCR:")
print(f"    f_ZCR[n] = {f_zcr}")
```

3. Resultado

```
1. Comprimento do vetor de características f[n]: 11

2. Valores de f[n] para Energia:
   f_energia[n] = [np.int64(5), np.int64(13), np.int64(18), np.int64(13), np.int64(5), np.int64(2), np.int64(2), np.int64(17), np.int64(41), np.int64(50), np.int64(41)]

3. Valores de f[n] para ZCR:
   f_ZCR[n] = [0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1]
```

Comprimento do vetor de características f[n]: 11

Valores de f[n] para Energia:

f_energia[n] = [5, 13, 18, 13, 5, 2, 2, 17, 41, 50, 41]

Valores de f[n] para ZCR:

f_ZCR[n] = [0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1]