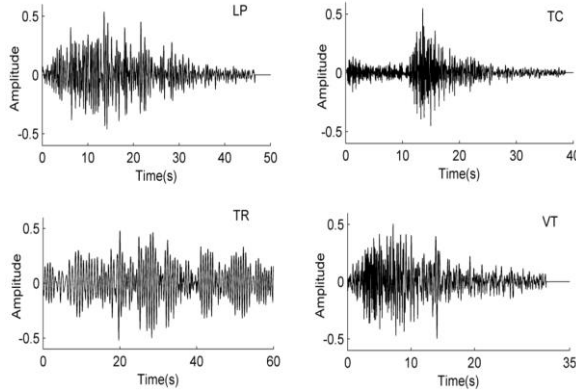
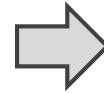


## Time Domain

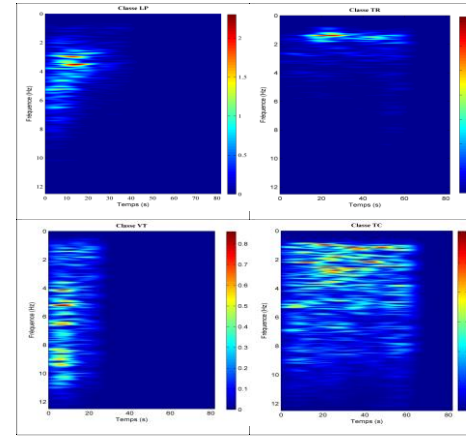


sampled signals  $u(m)$

Short Term Fourier Transform STFT



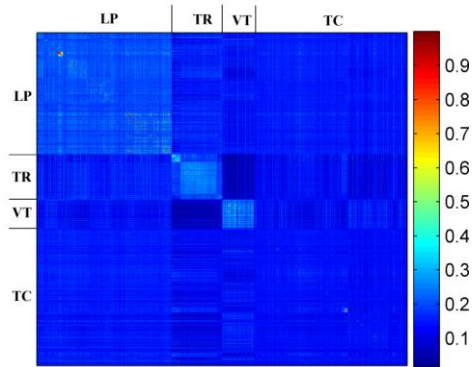
## Time-Frequency domain



spectrogram  $U(n,p)$

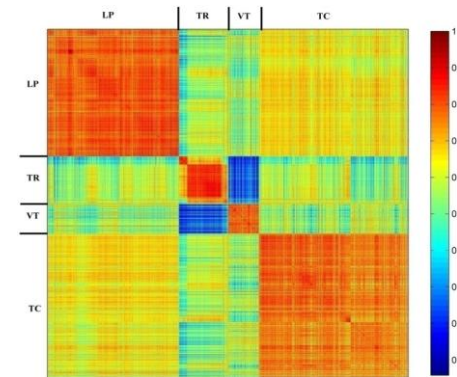
$$U(n,p) = \left| \sum_{m=1}^N u(m)w(m-n) e^{-i2\pi pm} \right|^2$$

1D cross-correlation



$$MNCC_{uv} = \frac{\max(|R_{uv}(k)|)}{\sqrt{R_{uu}(0)R_{vv}(0)}}$$

2D cross-correlation



$$MNCC_{UV} = \frac{\max(|R_{UV}(k)|)}{\sqrt{R_{UU}(0)R_{VV}(0)}}$$

Classification

**Global accuracy of 59,7%**



**Global accuracy of 92,48%**