Time domain features expressions.

Feature Name	Feature Expression	Feature Connotation
Max	$T_1 = max\langle x(i)\rangle$	Intensity
Min	$T_2 = min\langle x(i)\rangle$	Intensity
Mean	$T_3 = \frac{1}{N}\sum_{i=1}^{N} x(i)$	Shift
Variance	$T_4 = \frac{1}{N}\sum_{i=1}^{N} [x(i) - T_3]^2$	Degree of dispersion
Standard deviation	$T_5 = \sqrt{T_4}$	Stability
Mean absolute deviation	$T_6 = \frac{1}{N}\sum_{i=1}^{N} \lvert x(i) - T_3\rvert$	Degree of dispersion
Root mean square	$T_7 = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x(i)^2}$	Stability
Average difference	$T_8 = \frac{1}{N}\sum_{i=1}^{N} [x(i) - T_3]$	Amplitude scale
Absolute energy	$T_9 = \sum_{i=1}^{N} x(i)^2$	Energy distribution
Peak to peak distance	$T_{10} = T_1 - T_2$	Periodicity
Sum of absolute differences	$T_{11} = \sum_{i=0}^{N-1} \lvert x(i+1) - x(i)\rvert$	Intensity of change
Shannon Entropy	$T_{12} = -\sum_{i=1}^{N} p(x(i)) \cdot \log_2 p(x(i))$	Uncertainties
Area under the curve	$T_{13} = \sum_{i=0}^{N-1} [(i+1) - (i)] \cdot \frac{x(i+1) + x(i)}{2}$	Energy distribution
Autocorrelation	$T_{14} = \frac{\frac{1}{N-k}\sum_{i=k+1}^{N} [x(i) - T_3][x(i-k) - T_3]}{\frac{1}{N}\sum_{i=1}^{N} [x(i) - T_3]^2}$	Periodicity
Signal center point	$T_{15} = \frac{\sum_{i=0}^{N} i \cdot x(i)^2}{\sum_{i=0}^{N} x(i)^2}$	Shift
Neighbor peaks	$T_{16} = Number\ of\ peaks$	Repeatable
Signal distance	$T_{17} = \sum_{i=0}^{N-1} \sqrt{1 + [x(i+1) - x(i)]^2}$	Difference in point in time
Total energy	$T_{18} = \frac{\sum_{i=0}^{N} x(i)^2}{N}$	Overall strength and power
Zero crossing rate	$T_{19} = Number\ of\ signal\ reversals$	Rate of change
Skewness	$T_{20} = \frac{1}{N}\sum_{i=1}^{N} \left[\frac{x(i) - T_3}{T_5}\right]^3$	Symmetry
kurtosis	$T_{21} = \frac{1}{N}\sum_{i=1}^{N} \left[\frac{x(i) - T_3}{T_5}\right]^4$	Peak distribution pattern
Number of positive/negative turning points	$T_{22} = Number\ of\ PTP$ $T_{23} = Number\ of\ NTP$	Waveform characteristics

Frequency domain features expressions.

Feature Name	Feature Expression	Feature Connotation
Max power spectrum	$F_1 = MAX\langle S(f_k)\rangle, 0 \le f_k \le f_{\max}$	Main frequency components
Max frequency	$F_2 = MAX\langle f_k\rangle, 0 \le f_k \le f_{\max}$	High frequency and bandwidth
Median frequency	$F_3 = f_m$, which $\int_0^{f_m} S(f)df = 0.5\int S(f)df$	Spectral characteristics
Spectral centroid	$F_4 = \frac{\int f\cdot S(f)df}{\int S(f)df}$	The center of the frequency
Power bandwidth	$F_5 = \frac{f_h - f_l}{F_4}$ f_h is high frequency -3dB point, f_l is the low frequency -3dB point	Bandwidth and energy
Spectral distance	$F_6 = \int [S_1(f) - S_2(f)]^2 df$	Similarity between frequency
Spectral entropy	$F_7 = -\sum_{k=1}^{K} P(f_k)\cdot log_2 P(f_k)$, which $P(f_k) = \frac{S(f_k)}{\int S(f_k)df}$	Uncertainty in frequency
Spectral spread	$F_8 = \sqrt{\frac{\int (f-F_4)^2\cdot S(f)df}{\int S(f)df}}$	Bandwidth
Spectral skewness	$F_9 = \frac{\frac{\int (f-F_4)^3\cdot S(f)df}{\int S(f)df}}{{F_8}^3}$	Degree of skewness of the frequency
Spectral kurtosis	$F_{10} = \frac{\frac{\int (f-F_4)^4\cdot S(f)df}{\int S(f)df}}{{F_8}^4}$	Degree of kurtosis in the frequency
Spectral roll-off	$F_{11} = f_{off}$, which $\int_0^{f_{off}} S(f)df = 0.95\int S(f)df$	Energy decreases with frequency
Spectral roll-on	$F_{12} = f_{on}$, which $\int_0^{f_{on}} S(f)df = 1.15\int S(f)df$	Energy rises with frequency
Fundamental frequency	$F_{13} = f_a$, which $\lvert X(a)\rvert = max\langle X(k)\rangle$	Harmonic analysis
Human range energy	$F_{14} = \frac{\int_{0.6Hz}^{2.5Hz} S(f)df}{\int S(f)df}$	Body energy range
Spectral slope	$F_{15} = K\cdot log_2\left(\frac{H_{high}}{H_{low}}\right)$ H_{high}/H_{low} is the amplitude at high/low frequencies, K is the scaling factor	Filter characteristics and frequency response
Spectral variation	$F_{16} = 1 - \frac{\int_1^{f_K} f^2\cdot S_1(f)\cdot S_2(f)df}{\sqrt{\left[\int_1^{f_K/2} f^2\cdot S_1(f)df\right]\left[\int_{f_K/2}^{f_K} f^2\cdot S_2(f)df\right]}}$ $S_1(f)$ is $(1\sim\frac{f_K}{2})$ of the spectrum, $S_2(f)$ is $(\frac{f_K}{2}\sim f_K)$ of the spectrum	Spectral structure and frequency response