2 -Sound Characteristics

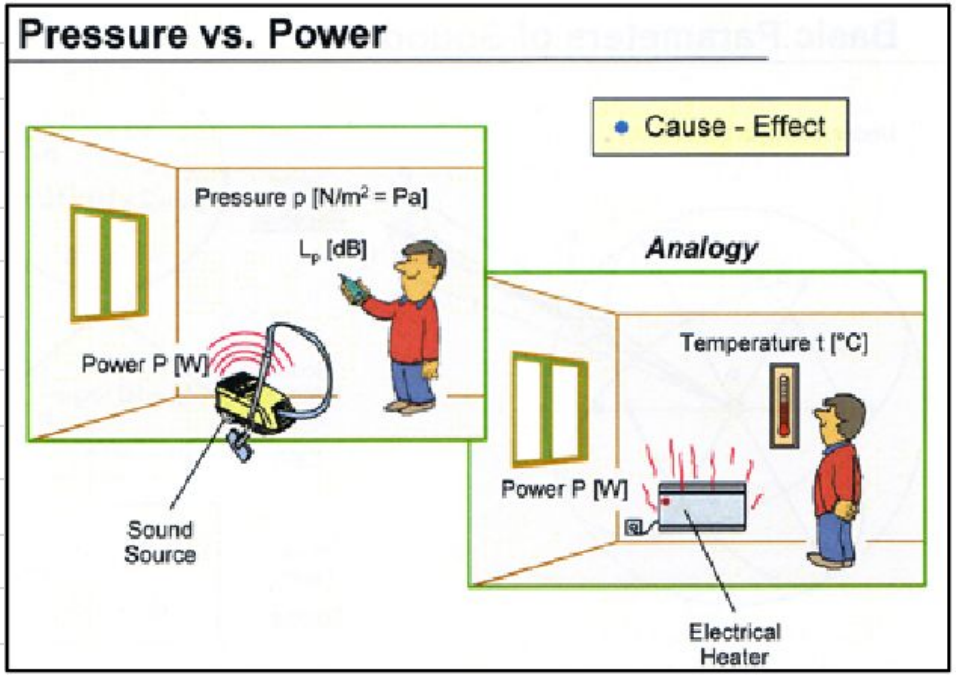
Inteligencia artificial avanzada para la ciencia de datos I Modulo 5 NLP 1

Tecnológico de Monterrey

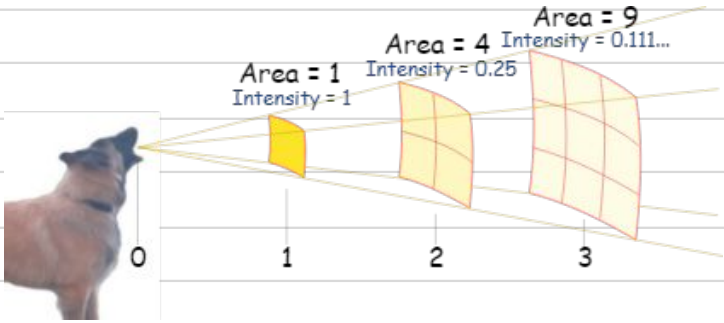
Power

"The amount of sound energy needs to be emitted, transmitted and received in a period of time"

Since power is a representation of kinetic energy, it's measured by Watts [W].



Intensity



As consequence of power, sound waves carrie power over space (Area), Intensity is the amount of power carried by sound waves in a perpendicular direction over an area.

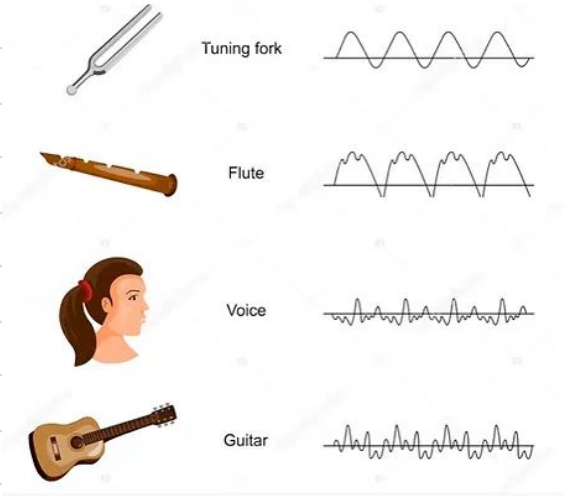
Intensity is measured in [W/m2], air pressure intensity as a consequence of a sound wave deformation, is expressed as :

10^{-12} W/m2 = 0 db

Source	Intensity	Intensity level
Threshold of hearing (TOH)	10^{-12}	0 dB
Whisper	10^{-10}	20 dB
Pianissimo	10^{-8}	40 dB
Normal conversation	10^{-6}	60 dB
Fortissimo	10^{-2}	100 dB
Threshold of pain	10	130 dB
Jet take-off	10^{2}	140 dB
Instant perforation of eardrum	10^{4}	160 dB

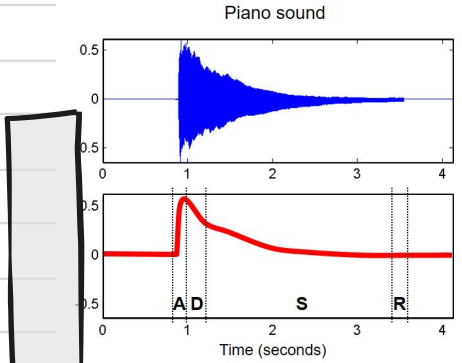
Timbre

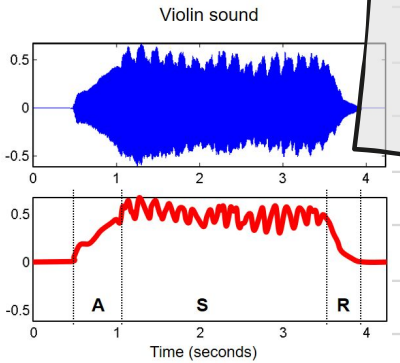
Although a violin wave sound (C3) may have the same frequency as a guitar wave sound(C3), and the same intensity (10 db), both sound and look different.



Sound Envelope

Sound behavior (pattern) which makes sound waves recognizable. For example piano and violin patterns are different by analyzing the sound envelope even if both have same frequency and pitch.





A-D-S-R Model

Attack

Peak of amplitude, usually increase dramatically

Decay

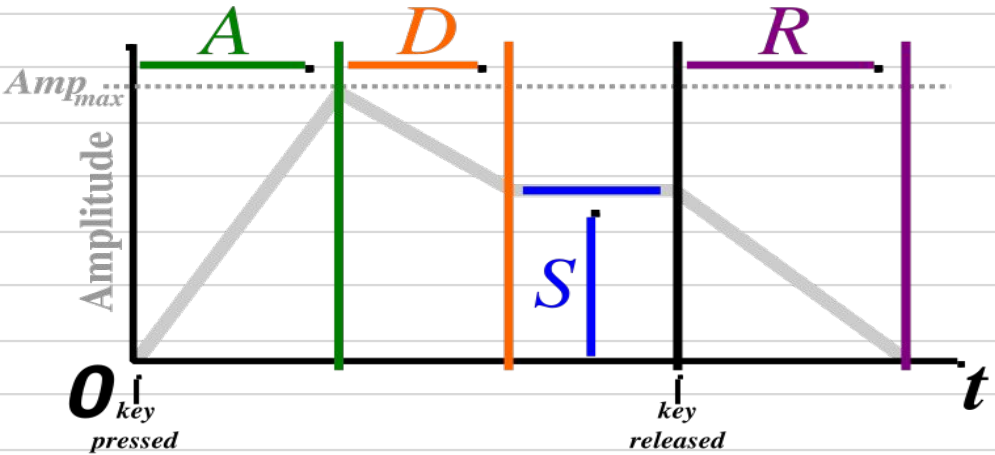
Amplitude decrease to reach stability in the sound

Sustain

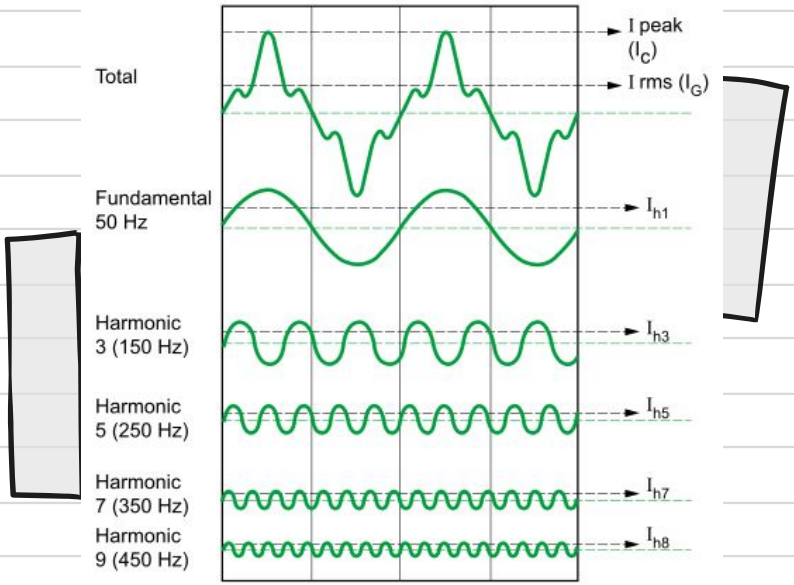
Period of time in which amplitude maintains

Release

Final phase of amplitude until it reaches zero



Complex Sound



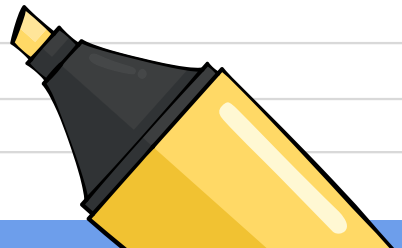
Real world sounds in nature usually consists in a superpositions of signals (sinusoids).

The lowest frequency sinusoid it's called the fundamental.

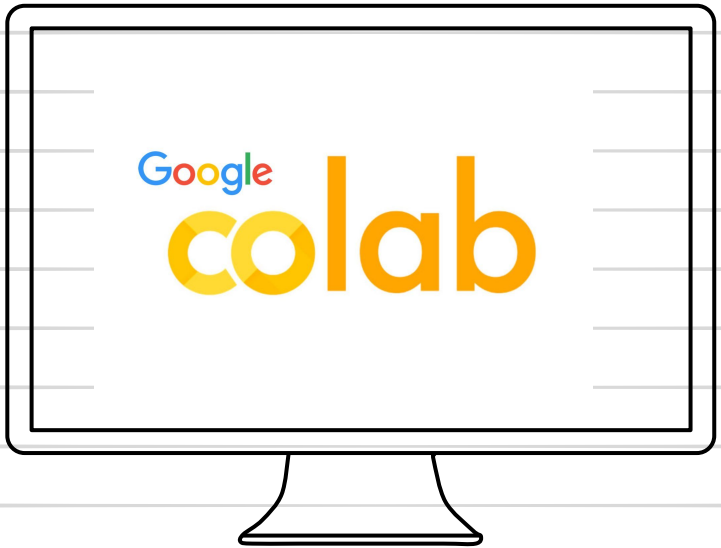
Each multiple of the fundamental, its an **harmonic**, in terms of sound harmonics sound great all together.

Quiz Time

Go to canvas and start quiz number 1



Coding Time



Exercise

1) Choose a sound or fragment song you like in .wav format
2) Create a colab Notebook
3) Plot the wavesound
5) Reduce the sound duration in seconds to half the time
4) Calculate the highest and lowest value of the wave amplitude
5) Choose a new sound or song and plot both wave sounds in the same display to compare them in two different colors and transparency.

Note: Try to explore librosa documentation to understand the methods and parameters.

https://librosa.org/doc/latest/index.html

Thanks!

Do you have any questions?

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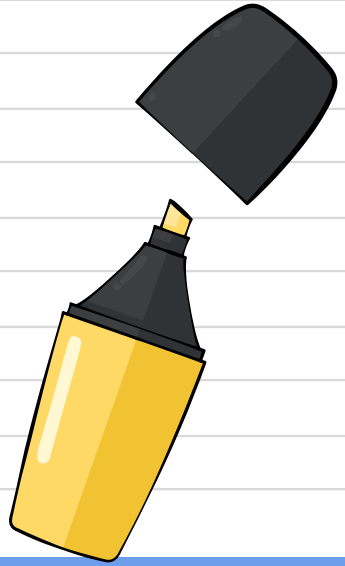
Slack #module-5-nlp-1



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