



# TRABAJO PRÁCTICO: ANÁLISIS DE AUDIO

Técnicas de Procesamiento del Lenguaje Natural

## DATOS:

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Año: 2025

## CONSIGNA:

Dado el audio: AnalisisTextos.mp3

### **1) Analizar el audio AnalisisTextos.mp3 con MediaInfo:**

Informar:

formato

tasa de bits

canales

frecuencia de muestreo

### **2) Realizar el sampleo con ffmpeg**

### **3) Analizar el audio nuevamente con MediaInfo**

*Informar:*

*formato*

*tasa de bits*

*canales*

*formato de muestreo*

**4) Con Python: Mostrar el Vector de la señal segmentada-Mostrar la cantidad de elementos de la muestra-Mostrar la Frecuencia de Muestreo-Mostrar la duración en segundos del audio**

**5) Imprimir la señal sonora**

**6) Reproducir la señal original**

**7) Modificar la frecuencia de muestreo para que dure más y menos tiempo. Explicar que sucede con el sonido**

**8) Bajar la calidad del audio y reproducir la señal.**

**Explicar cuál es el proceso.**

## RESOLUCIÓN:

1) Analizar el audio AnalisisTextos.mp3 con MediaInfo:

```
MediaInfo report of "AnalisisTextos.mp3" :

General
Complete name           : AnalisisTextos.mp3
Format                  : MPEG Audio
File size               : 219 KiB
Duration                : 7 s 12 ms
Overall bit rate mode   : Constant
Overall bit rate        : 256 kb/s
Writing library         : LAME®

Audio
Format                  : MPEG Audio
Format version          : Version 1
Format profile          : Layer 3
Duration                : 7 s 12 ms
Bit rate mode           : Constant
Bit rate                : 256 kb/s
Channel(s)              : 1 channel
Sampling rate           : 48.0 kHz
Frame rate              : 41.667 FPS (1152 SPF)
Compression mode        : Lossy
Stream size             : 219 KiB (100%) / 219 KiB (100%) / 219 KiB (100%) / 219 KiB (100%)
Writing library         : LAME®
```

**Tasa de Bits: 256kb/s**

**Formato de muestro: 48.0 kHz**

```

Microsoft Windows [Version 10.0.19045.5065]
(c) Microsoft Corporation. Todos los derechos reservados.

C:\ffmpeg>ffmpeg -i AnalisisTextos.mp3 -ar 16k -ac 1 AnalisisTextos.wav
ffmpeg version 4.1-190111.gd4556c98f0-20250602 Copyright (c) 2000-2025 the Ffmpeg developers
built with gcc 15.1.0 (crossroot-ml-1.27.0.42.35c1e72)
configuration: --prefix=/ffmpeg/build/prefix --pkg-config-flags=--static --pkg-config=pkg-config --cross-prefix=x86_64-w64-mingw32- --arch=x86_64 --target-os=mingw32 --enable-gpl --enable-version3 --disable-debug --enable-shared --disable-static --disable-w32threads --enable-pthreads --enable-iconv --enable-zlib --enable-libfribidi --enable-libgsm --enable-liblsm2 --enable-lzma --enable-fontconfig --enable-libharfbuzz --enable-libfreetype --enable-libvorbis --enable-opengl --disable-lbplulse --enable-libvorbis --enable-libvpx --enable-libx264 --enable-amf --enable-libaom --enable-libaribb24 --enable-avisynth --enable-chromaprint --enable-libdav1d --enable-libdav1d2 --enable-libdav1d3 --enable-libdav1d4 --enable-libdav1d5 --enable-libdav1d6 --enable-libdav1d7 --enable-libdav1d8 --enable-libdav1d9 --enable-libdav1d10 --enable-libdav1d11 --enable-libdav1d12 --enable-libdav1d13 --enable-libdav1d14 --enable-libdav1d15 --enable-libdav1d16 --enable-libdav1d17 --enable-libdav1d18 --enable-libdav1d19 --enable-libdav1d20 --enable-libdav1d21 --enable-libdav1d22 --enable-libdav1d23 --enable-libdav1d24 --enable-libdav1d25 --enable-libdav1d26 --enable-libdav1d27 --enable-libdav1d28 --enable-libdav1d29 --enable-libdav1d30 --enable-libdav1d31 --enable-libdav1d32 --enable-libdav1d33 --enable-libdav1d34 --enable-libdav1d35 --enable-libdav1d36 --enable-libdav1d37 --enable-libdav1d38 --enable-libdav1d39 --enable-libdav1d40 --enable-libdav1d41 --enable-libdav1d42 --enable-libdav1d43 --enable-libdav1d44 --enable-libdav1d45 --enable-libdav1d46 --enable-libdav1d47 --enable-libdav1d48 --enable-libdav1d49 --enable-libdav1d50 --enable-libdav1d51 --enable-libdav1d52 --enable-libdav1d53 --enable-libdav1d54 --enable-libdav1d55 --enable-libdav1d56 --enable-libdav1d57 --enable-libdav1d58 --enable-libdav1d59 --enable-libdav1d60 --enable-libdav1d61 --enable-libdav1d62 --enable-libdav1d63 --enable-libdav1d64 --enable-libdav1d65 --enable-libdav1d66 --enable-libdav1d67 --enable-libdav1d68 --enable-libdav1d69 --enable-libdav1d70 --enable-libdav1d71 --enable-libdav1d72 --enable-libdav1d73 --enable-libdav1d74 --enable-libdav1d75 --enable-libdav1d76 --enable-libdav1d77 --enable-libdav1d78 --enable-libdav1d79 --enable-libdav1d80 --enable-libdav1d81 --enable-libdav1d82 --enable-libdav1d83 --enable-libdav1d84 --enable-libdav1d85 --enable-libdav1d86 --enable-libdav1d87 --enable-libdav1d88 --enable-libdav1d89 --enable-libdav1d90 --enable-libdav1d91 --enable-libdav1d92 --enable-libdav1d93 --enable-libdav1d94 --enable-libdav1d95 --enable-libdav1d96 --enable-libdav1d97 --enable-libdav1d98 --enable-libdav1d99 --enable-libdav1d100 --enable-libdav1d101 --enable-libdav1d102 --enable-libdav1d103 --enable-libdav1d104 --enable-libdav1d105 --enable-libdav1d106 --enable-libdav1d107 --enable-libdav1d108 --enable-libdav1d109 --enable-libdav1d110 --enable-libdav1d111 --enable-libdav1d112 --enable-libdav1d113 --enable-libdav1d114 --enable-libdav1d115 --enable-libdav1d116 --enable-libdav1d117 --enable-libdav1d118 --enable-libdav1d119 --enable-libdav1d120 --enable-libdav1d121 --enable-libdav1d122 --enable-libdav1d123 --enable-libdav1d124 --enable-libdav1d125 --enable-libdav1d126 --enable-libdav1d127 --enable-libdav1d128 --enable-libdav1d129 --enable-libdav1d130 --enable-libdav1d131 --enable-libdav1d132 --enable-libdav1d133 --enable-libdav1d134 --enable-libdav1d135 --enable-libdav1d136 --enable-libdav1d137 --enable-libdav1d138 --enable-libdav1d139 --enable-libdav1d140 --enable-libdav1d141 --enable-libdav1d142 --enable-libdav1d143 --enable-libdav1d144 --enable-libdav1d145 --enable-libdav1d146 --enable-libdav1d147 --enable-libdav1d148 --enable-libdav1d149 --enable-libdav1d150 --enable-libdav1d151 --enable-libdav1d152 --enable-libdav1d153 --enable-libdav1d154 --enable-libdav1d155 --enable-libdav1d156 --enable-libdav1d157 --enable-libdav1d158 --enable-libdav1d159 --enable-libdav1d160 --enable-libdav1d161 --enable-libdav1d162 --enable-libdav1d163 --enable-libdav1d164 --enable-libdav1d165 --enable-libdav1d166 --enable-libdav1d167 --enable-libdav1d168 --enable-libdav1d169 --enable-libdav1d170 --enable-libdav1d171 --enable-libdav1d172 --enable-libdav1d173 --enable-libdav1d174 --enable-libdav1d175 --enable-libdav1d176 --enable-libdav1d177 --enable-libdav1d178 --enable-libdav1d179 --enable-libdav1d180 --enable-libdav1d181 --enable-libdav1d182 --enable-libdav1d183 --enable-libdav1d184 --enable-libdav1d185 --enable-libdav1d186 --enable-libdav1d187 --enable-libdav1d188 --enable-libdav1d189 --enable-libdav1d190 --enable-libdav1d191 --enable-libdav1d192 --enable-libdav1d193 --enable-libdav1d194 --enable-libdav1d195 --enable-libdav1d196 --enable-libdav1d197 --enable-libdav1d198 --enable-libdav1d199 --enable-libdav1d200 --enable-libdav1d201 --enable-libdav1d202 --enable-libdav1d203 --enable-libdav1d204 --enable-libdav1d205 --enable-libdav1d206 --enable-libdav1d207 --enable-libdav1d208 --enable-libdav1d209 --enable-libdav1d210 --enable-libdav1d211 --enable-libdav1d212 --enable-libdav1d213 --enable-libdav1d214 --enable-libdav1d215 --enable-libdav1d216 --enable-libdav1d217 --enable-libdav1d218 --enable-libdav1d219 --enable-libdav1d220 --enable-libdav1d221 --enable-libdav1d222 --enable-libdav1d223 --enable-libdav1d224 --enable-libdav1d225 --enable-libdav1d226 --enable-libdav1d227 --enable-libdav1d228 --enable-libdav1d229 --enable-libdav1d230 --enable-libdav1d231 --enable-libdav1d232 --enable-libdav1d233 --enable-libdav1d234 --enable-libdav1d235 --enable-libdav1d236 --enable-libdav1d237 --enable-libdav1d238 --enable-libdav1d239 --enable-libdav1d240 --enable-libdav1d241 --enable-libdav1d242 --enable-libdav1d243 --enable-libdav1d244 --enable-libdav1d245 --enable-libdav1d246 --enable-libdav1d247 --enable-libdav1d248 --enable-libdav1d249 --enable-libdav1d250 --enable-libdav1d251 --enable-libdav1d252 --enable-libdav1d253 --enable-libdav1d254 --enable-libdav1d255 --enable-libdav1d256 --enable-libdav1d257 --enable-libdav1d258 --enable-libdav1d259 --enable-libdav1d260 --enable-libdav1d261 --enable-libdav1d262 --enable-libdav1d263 --enable-libdav1d264 --enable-libdav1d265 --enable-libdav1d266 --enable-libdav1d267 --enable-libdav1d268 --enable-libdav1d269 --enable-libdav1d270 --enable-libdav1d271 --enable-libdav1d272 --enable-libdav1d273 --enable-libdav1d274 --enable-libdav1d275 --enable-libdav1d276 --enable-libdav1d277 --enable-libdav1d278 --enable-libdav1d279 --enable-libdav1d280 --enable-libdav1d281 --enable-libdav1d282 --enable-libdav1d283 --enable-libdav1d284 --enable-libdav1d285 --enable-libdav1d286 --enable-libdav1d287 --enable-libdav1d288 --enable-libdav1d289 --enable-libdav1d290 --enable-libdav1d291 --enable-libdav1d292 --enable-libdav1d293 --enable-libdav1d294 --enable-libdav1d295 --enable-libdav1d296 --enable-libdav1d297 --enable-libdav1d298 --enable-libdav1d299 --enable-libdav1d300 --enable-libdav1d301 --enable-libdav1d302 --enable-libdav1d303 --enable-libdav1d304 --enable-libdav1d305 --enable-libdav1d306 --enable-libdav1d307 --enable-libdav1d308 --enable-libdav1d309 --enable-libdav1d310 --enable-libdav1d311 --enable-libdav1d312 --enable-libdav1d313 --enable-libdav1d314 --enable-libdav1d315 --enable-libdav1d316 --enable-libdav1d317 --enable-libdav1d318 --enable-libdav1d319 --enable-libdav1d320 --enable-libdav1d321 --enable-libdav1d322 --enable-libdav1d323 --enable-libdav1d324 --enable-libdav1d325 --enable-libdav1d326 --enable-libdav1d327 --enable-libdav1d328 --enable-libdav1d329 --enable-libdav1d330 --enable-libdav1d331 --enable-libdav1d332 --enable-libdav1d333 --enable-libdav1d334 --enable-libdav1d335 --enable-libdav1d336 --enable-libdav1d337 --enable-libdav1d338 --enable-libdav1d339 --enable-libdav1d340 --enable-libdav1d341 --enable-libdav1d342 --enable-libdav1d343 --enable-libdav1d344 --enable-libdav1d345 --enable-libdav1d346 --enable-libdav1d347 --enable-libdav1d348 --enable-libdav1d349 --enable-libdav1d350 --enable-libdav1d351 --enable-libdav1d352 --enable-libdav1d353 --enable-libdav1d354 --enable-libdav1d355 --enable-libdav1d356 --enable-libdav1d357 --enable-libdav1d358 --enable-libdav1d359 --enable-libdav1d360 --enable-libdav1d361 --enable-libdav1d362 --enable-libdav1d363 --enable-libdav1d364 --enable-libdav1d365 --enable-libdav1d366 --enable-libdav1d367 --enable-libdav1d368 --enable-libdav1d369 --enable-libdav1d370 --enable-libdav1d371 --enable-libdav1d372 --enable-libdav1d373 --enable-libdav1d374 --enable-libdav1d375 --enable-libdav1d376 --enable-libdav1d377 --enable-libdav1d378 --enable-libdav1d379 --enable-libdav1d380 --enable-libdav1d381 --enable-libdav1d382 --enable-libdav1d383 --enable-libdav1d384 --enable-libdav1d385 --enable-libdav1d386 --enable-libdav1d387 --enable-libdav1d388 --enable-libdav1d389 --enable-libdav1d390 --enable-libdav1d391 --enable-libdav1d392 --enable-libdav1d393 --enable-libdav1d394 --enable-libdav1d395 --enable-libdav1d396 --enable-libdav1d397 --enable-libdav1d398 --enable-libdav1d399 --enable-libdav1d400 --enable-libdav1d401 --enable-libdav1d402 --enable-libdav1d403 --enable-libdav1d404 --enable-libdav1d405 --enable-libdav1d406 --enable-libdav1d407 --enable-libdav1d408 --enable-libdav1d409 --enable-libdav1d410 --enable-libdav1d411 --enable-libdav1d412 --enable-libdav1d413 --enable-libdav1d414 --enable-libdav1d415 --enable-libdav1d416 --enable-libdav1d417 --enable-libdav1d418 --enable-libdav1d419 --enable-libdav1d420 --enable-libdav1d421 --enable-libdav1d422 --enable-libdav1d423 --enable-libdav1d424 --enable-libdav1d425 --enable-libdav1d426 --enable-libdav1d427 --enable-libdav1d428 --enable-libdav1d429
```

```
ffmpeg -i AnalisisTextos.mp3 -ar 16k -ac 1 AnalisisTextos.wav
```

### 3) Análisis del audio wav:

#### MediaInfo report of "AnalisisTextos.wav" :

```
General
Complete name      : AnalisisTextos.wav
Format             : Wave
Format settings    : PcmWaveformat
File size          : 220 KiB
Duration           : 7 s 32 ms
Overall bit rate mode : Constant
Overall bit rate   : 256 kb/s
Writing application : Lavf62.0.102

Audio
Format             : PCM
Format settings    : Little / Signed
Codec ID           : 1
Duration           : 7 s 32 ms
Bit rate mode      : Constant
Bit rate           : 256 kb/s
Channel(s)         : 1 channel
Sampling rate      : 16.0 kHz
Bit depth          : 16 bits
Stream size        : 220 KiB (100%) / 220 KiB (100%)
```

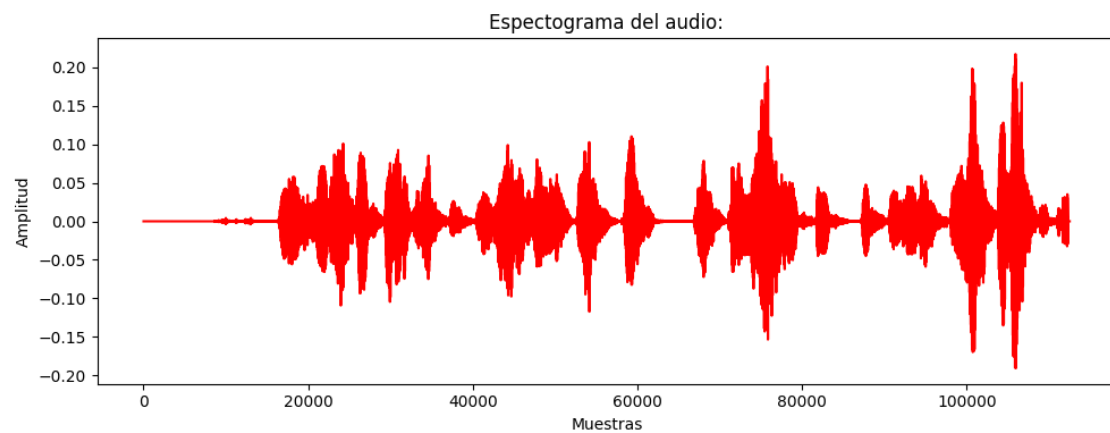
**Formato:** PCM

**Tasa de Bits:** 256kb/s

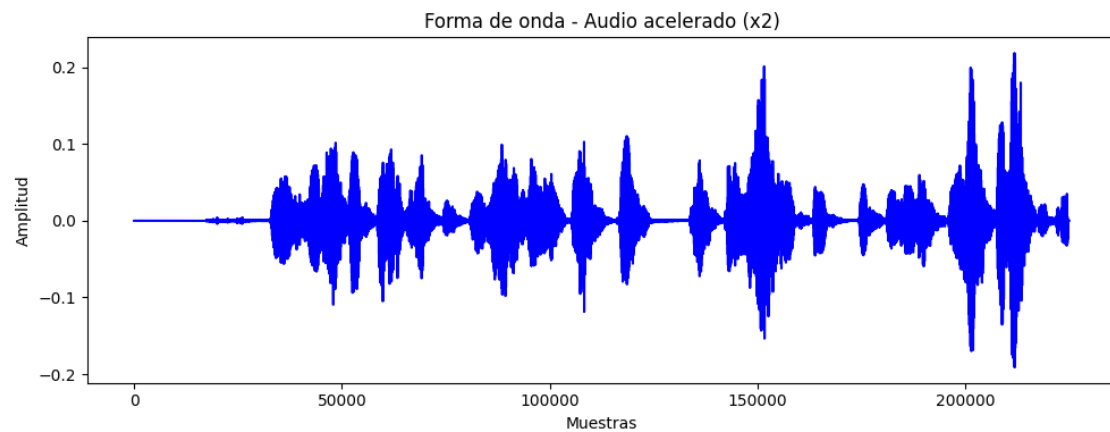
**Canales:** 1 CANAL - MONO

**Formato de muestro:** 16.0 kHz

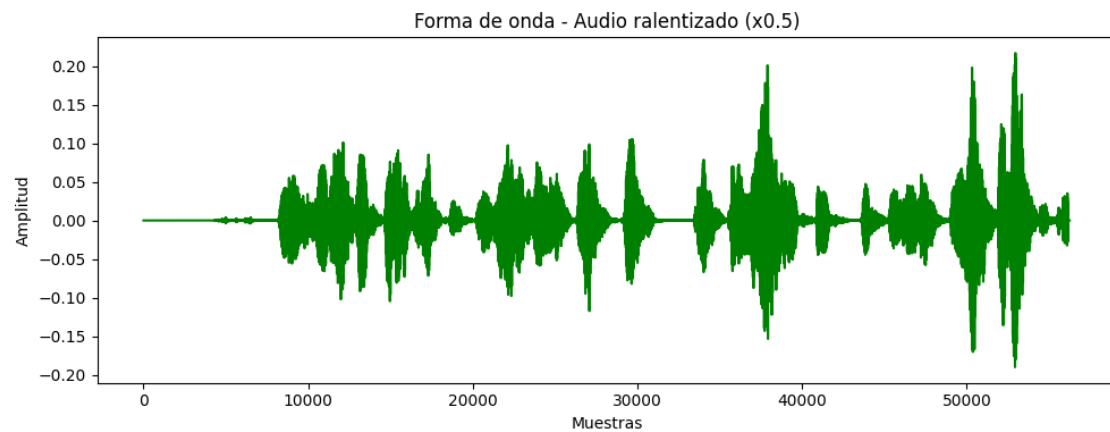
**AUDIO ORIGINAL:**



## AUDIO ACELERADO:



## AUDIO REALENTIZADO:



En el código implementa un conjunto de operaciones de análisis y transformación de un archivo de audio (AnalisisTextos.wav) utilizando las bibliotecas **NumPy**, **Matplotlib**, **librosa** y **soundfile**.

El análisis se realizó mediante los siguientes pasos:

### Carga y visualización de información básica

- Se utiliza `soundfile.read()` para leer el archivo de audio, obteniendo el vector de la señal (audio) y su **frecuencia de muestreo** (sr).
- Se muestra información clave, incluyendo:
  - El **vector de la señal segmentada**.
  - La cantidad total de elementos de la muestra.
  - La **frecuencia de muestreo**, expresada en Hz.
  - La **duración** del audio, calculada como `len(audio) / sr`.

### Reproducción y visualización del audio original

- Se utiliza `IPython.display.Audio()` para reproducir el **audio sin modificaciones**.
- Se grafica la **forma de onda** mediante `matplotlib.pyplot.plot()`, mostrando la amplitud de la señal en función de las muestras.

### Modificación de velocidad del audio

Se generan dos versiones modificadas del audio:

- **Aceleración (X2):**
  - Se duplica la frecuencia de muestreo ( $sr * 2$ ), generando una versión más rápida.
  - Se usa `librosa.resample()` para recalcular la señal con la nueva frecuencia.
  - Se grafica la nueva forma de onda en color azul.
- **Ralentización (X0.5):**
  - Se reduce la frecuencia de muestreo a la mitad ( $sr // 2$ ), generando una versión más lenta.
  - Se usa `librosa.resample()` para ajustar la señal.
  - Se grafica la nueva forma de onda en color verde.

### Reducción de calidad del audio

- Se modifica la **tasa de bits**, reduciendo la precisión de la representación digital del audio.
- Se multiplica la señal por  $2^{*3}$  y se convierte a `int8`, degradando la calidad.

## CONCLUSIONES:

Este análisis de audio permitió explorar diferentes transformaciones, desde el ajuste de velocidad hasta la reducción de calidad. Mediante herramientas como **librosa** y **matplotlib**, se visualizaron las variaciones de la señal y sus efectos en la reproducción. Estas técnicas pueden ser útiles en aplicaciones de análisis de sonido, accesibilidad o incluso edición de audio.