

Fundamental Frequency of a Human Voice

▼ Introduction

This application predicts the fundamental frequency of a human voice using the [RealCepstrum](#) command



```
> restart:
  with(ColorTools):
  with(plots):
  with(SignalProcessing):
  with(DocumentTools):
  with(AudioTools):
```

▼ Import and Visualize Audio

```
> aud := Read(FileTools:-JoinPath([kernelopts(datadir), "audio",
  "maplesim.wav"]));
Fs := attributes(aud)[1]
```

$$aud := \begin{bmatrix} \text{"Sample Rate"} & 11025 \\ \text{"Bit Depth"} & 16 \\ \text{"Channels"} & 1 \\ \text{"Points/Channel"} & 8227 \\ \text{"Duration"} & 0.75 \text{ s} \end{bmatrix}$$

$F_s := 11025$

(2.1)

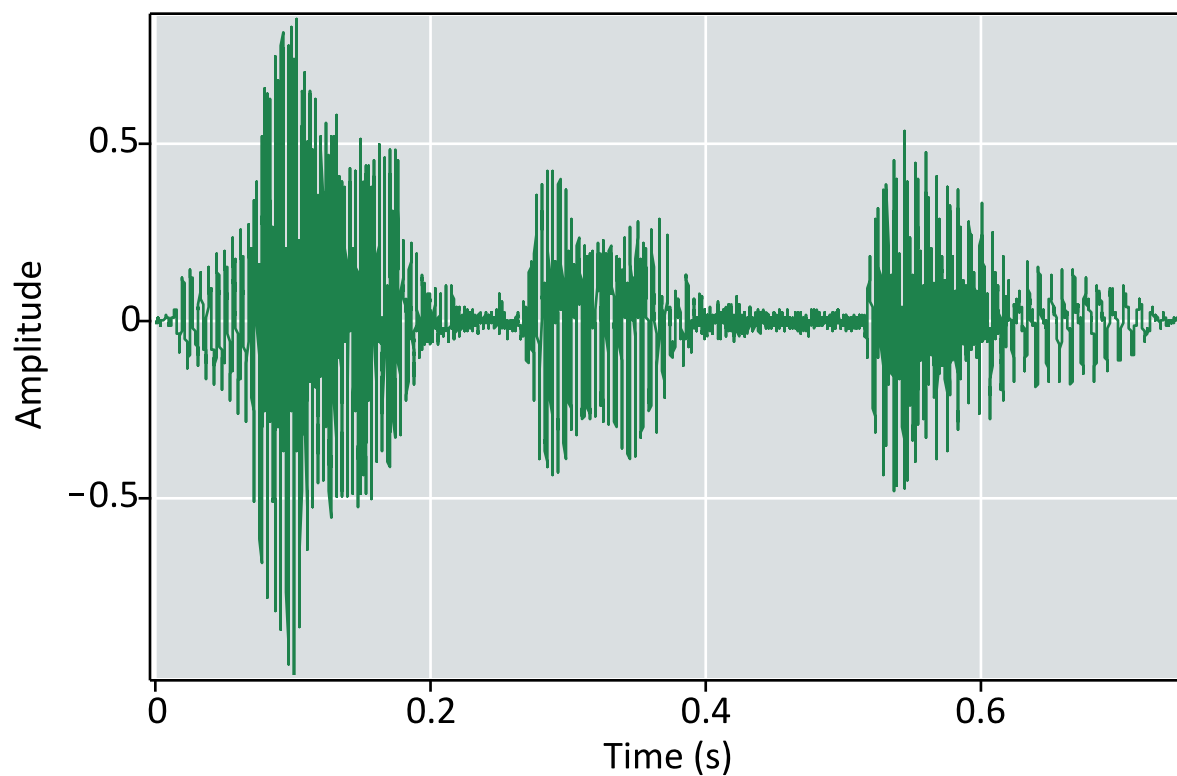
Play the audio

```
> SetProperty("Speaker0", samplerate, Fs);
  Play(aud, "Speaker0")
```

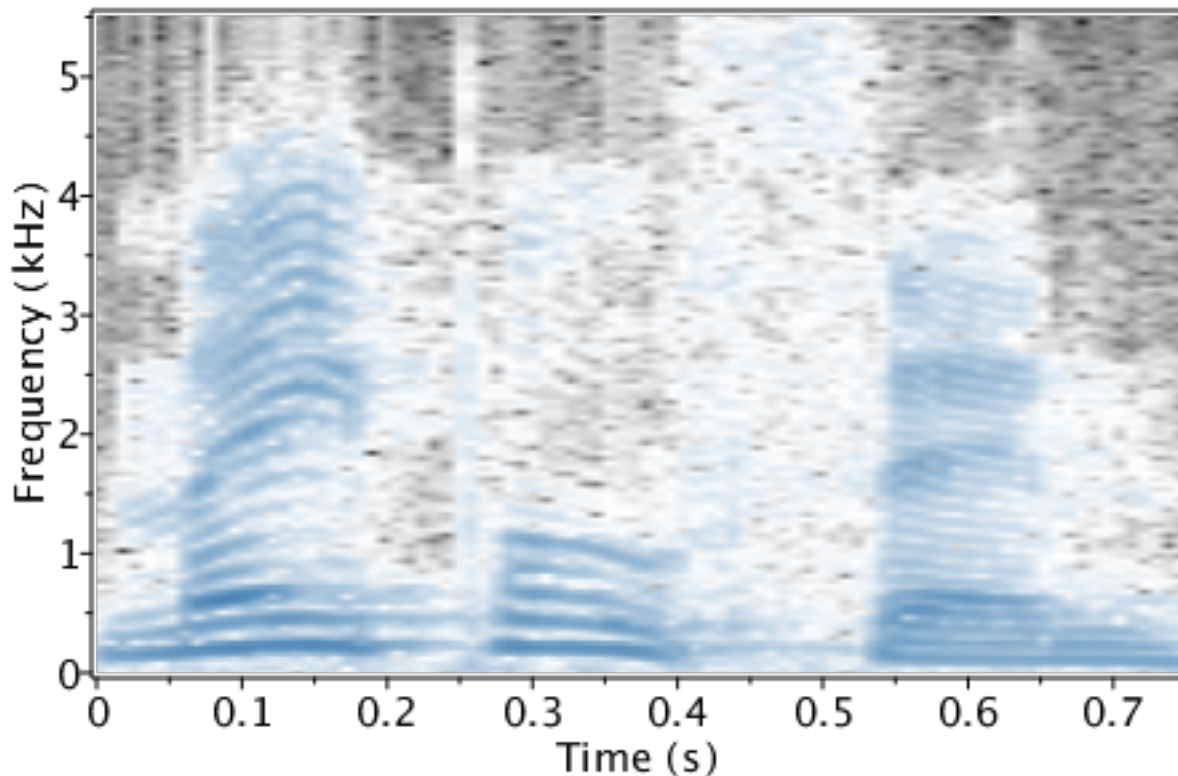
```
> t := Vector(numelems(aud), i-> 1.0*(i-1)/Fs, datatype = float[8]
):
```

```
pltOrigAudio := plot(t, aud, thickness = 0, color = Color("RGB",
  [30/255, 130/255, 76/255]), axes = boxed, size = [800,300], font
```

```
= [Calibri], labels = ["Time (s)", "Amplitude"], labeldirections
= [horizontal, vertical], labelfont = [Calibri], background =
Color("RGB", [218/255, 223/255, 225/255]), axis = [gridlines =
[5, color = Color("RGB", [1, 1, 1])]]);
```



```
> Spectrogram(aud, size = [800,300], colorscheme = [black, white,
"SteelBlue"], overlap = 0.65)
```



▼ Extract Segment of Audio to Analyze

Select the "a" sound of audio

```
> dt      := 1. / Fs;
  I0      := round(0.1 / dt) + 1;
  Iend    := round(0.29 / dt) + 1;
  audSeg  := aud[I0 .. Iend];
  Play(audSeg, "Speaker0")
```

$dt := 0.00009070294785$

$I0 := 1104$

$Iend := 3198$

$audSeg :=$

"Sample Rate"	11025
"Bit Depth"	16
"Channels"	1
"Points/Channel"	3198
"Duration"	0.19 s

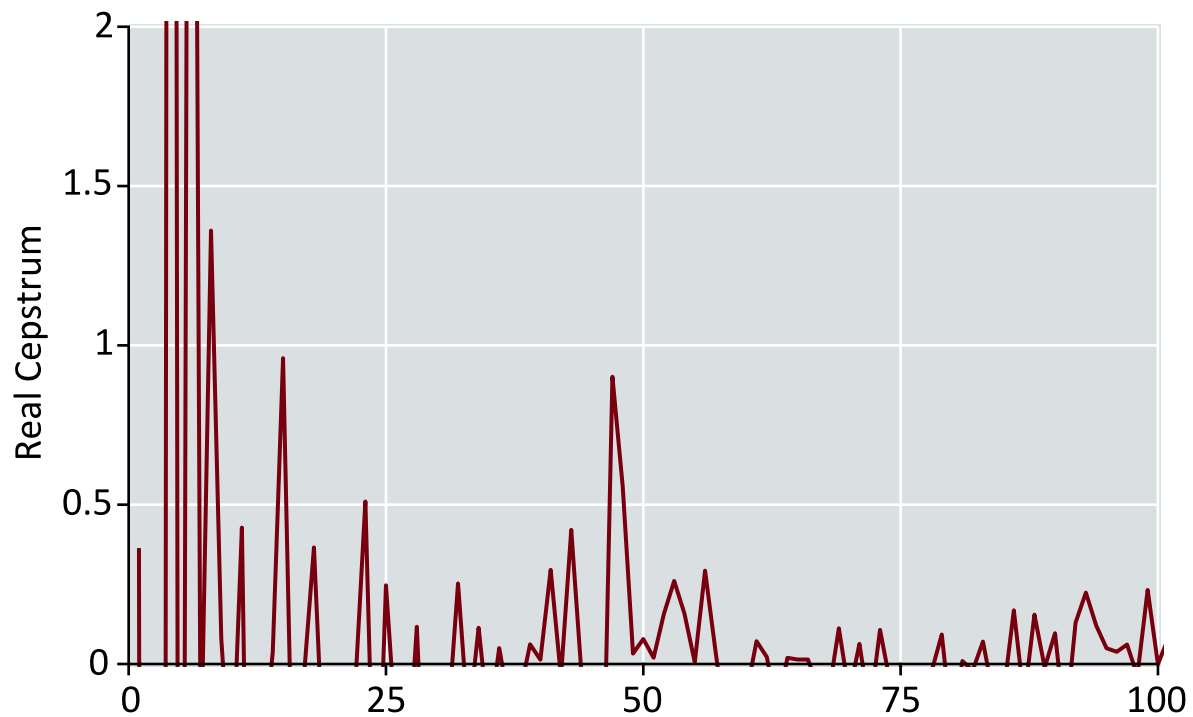
(3.1)

▼ Calculate and Plot the Real Cepstrum

```
> c      := ComplexCepstrum(audSeg)[1]:
  ind    := [seq(i, i = 1 .. numelems(c))]:

  plot(ind, c, view = [0 .. 100, 0 .. 2], size = [800,300], font =
    [Calibri], labels = ["", "Real Cepstrum"], labeldirections =
```

```
[horizontal, vertical], labelfont = [Calibri], background =
Color("RGB", [218/255, 223/255, 225/255]), axis = [gridlines =
[5, color = Color("RGB", [1, 1, 1])]])
```



A large peak occurs at an index of 48. Hence the fundamental frequency is
speaker is

> Fs / 48.

229.6875000

(4.1)