Voice Technology Solution to Detect COVID 19

1. INTRODUCTION

Voice technologies like Google Assistant, Amazon Alexa, and Apple Siri are beginning to have a major impact on people's daily lives.

So far, the focus has been on voice tech's ability to hail cabs, order pizza, select entertainment, or provide weather updates. But it's increasingly apparent that voice can play a critical role in helping people manage chronic health conditions from home and this technology developing more and more.

As we know, there are lots of positive cases of COVID 19 and suspected people feel symptoms but do not dare to go to the hospital for a check-up.

Changing in voice because of sore throat is one of those symptoms which can play a vital role to detect the COVID 19 using voice analysis technology.

Advantage

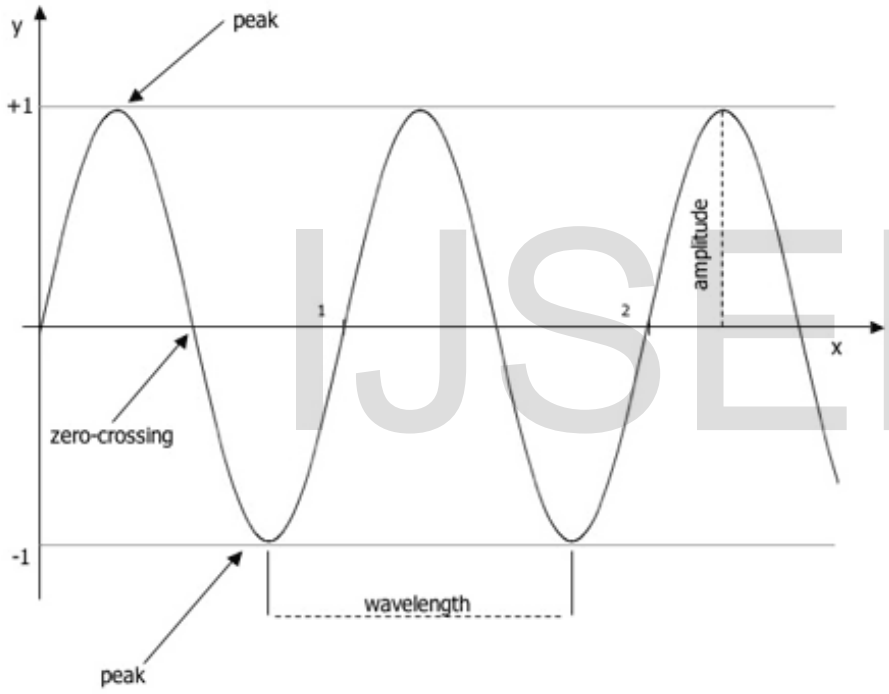
- The most advantage of this technology is that it can be used anywhere at home as well as at workplaces.
- After considering all security conditions for people voice recognition does not have any limitation for testing should be followed by people.
- For voice recognition, we do not need any special device. it can be used in mobile phones as well as online.
- After a voice analysis test, people do not need to wait for a long time. it can provide an instantaneous result.

So, after considering all facts that how voice technology can be helpful to detect COVID 19 without any drawbacks, we are working on this technology with many organizations to make this way more efficient and helpful.

2. RESEARCH AND FINDINGS

When we think about the voice processing many features come in our mind. But zero crossing and sampling rate are one of them.

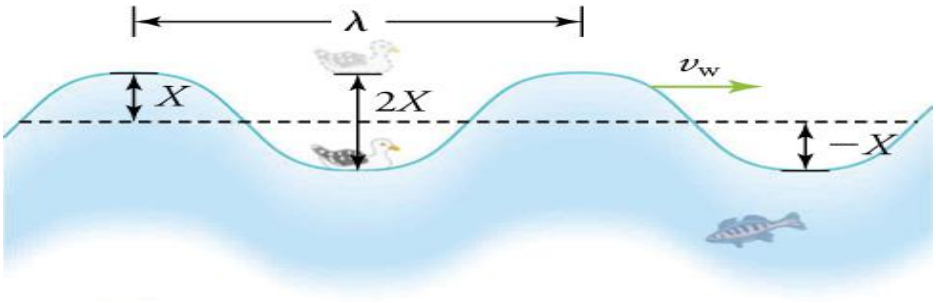
Zero crossing: -



For a sound wave the **zero-crossing** is the instantaneous point at which amplitude is zero. In a sine **wave** or other simple waveform, this normally occurs twice during each cycle.

Normally we say, A high amplitude wave is a high-energy wave, and a low-amplitude wave is a low-energy wave. In the case of sound waves, a high amplitude sound will be loud, and a low amplitude sound will be quiet. But amplitude isn't the only factor that affects the energy of a wave. The other factor is frequency. **Frequency** is the number of ways that pass by each second, measured in hertz. So, a wave of a particular amplitude has more energy per second if it has a higher frequency, simply because more waves are passing by in a given period of time.

We can understand this process deeply with the help of this given figure below.



Consider the periodic water wave in Figure. Its wavelength is the distance from crest to crest or from trough to trough. The wavelength can also be thought of as the distance a wave has travelled after one complete cycle (or one period). The time for one complete up-and-down motion is the simple water wave's period *T*. In the figure, the wave itself moves to the right with a wave velocity v_w. Its amplitude *X* is the distance between the resting position and the maximum displacement (either the crest or the trough) of the wave. It is important to note that this movement of the wave is actually the *disturbance* moving to the right, not the water itself (otherwise, the bird would move to the right). Instead, the seagull bobs up and down in place as waves pass underneath, traveling a total distance of 2*X* in one cycle.

Since wave frequency is the number of waves per second, and the period is essentially the number of seconds per wave, the relationship between frequency and period is

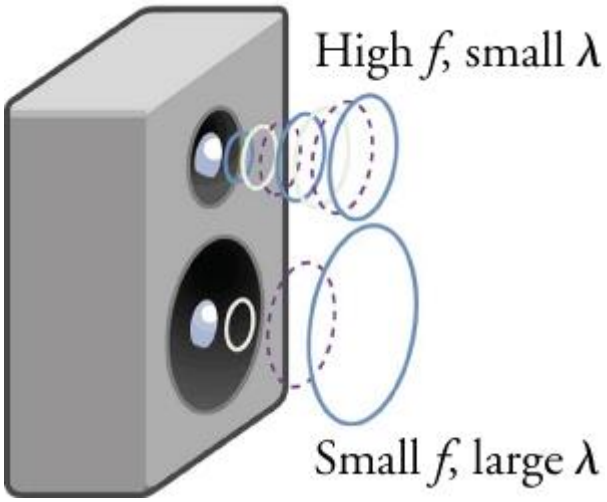
$$f=1/T$$

just as in the case of harmonic motion of an object. We can see from this relationship that a higher frequency means a shorter period. Recall that the unit for frequency is hertz (Hz), and that 1 Hz is one cycle (or one wave) per second.

The speed of propagation v_w is the distance the wave travels in a given time, which is one wavelength in a time of one period. In equation form, it is written as

$$v_w=\lambda/T$$

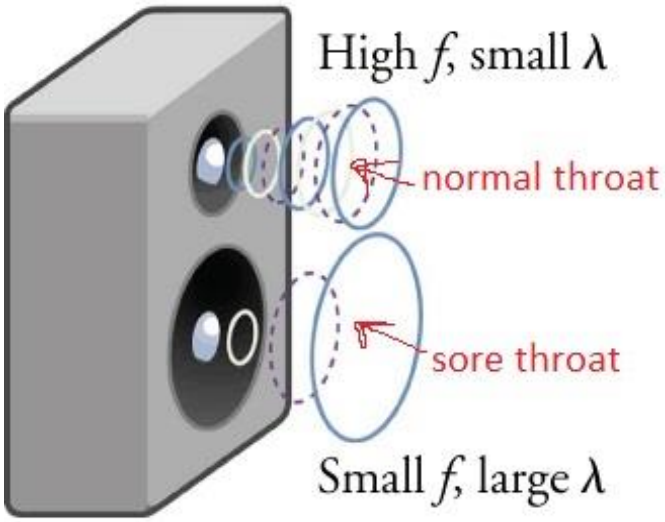
From this relationship, we see that in a medium where v_w is constant, the higher the frequency, the smaller the wavelength. See Figure.



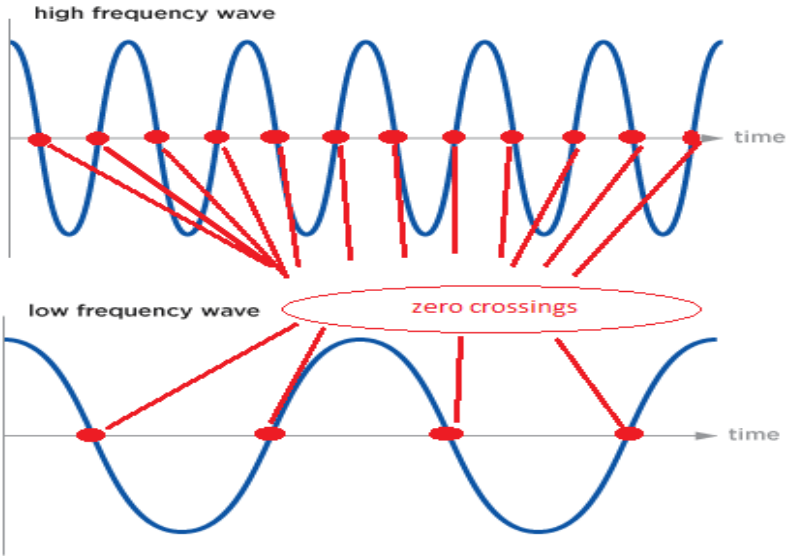
Because they travel at the same speed in a given medium, low-frequency sounds must have a greater wavelength than high-frequency sounds. Here, the lower-frequency sounds are emitted by the large speaker, called a woofer, while the higher-frequency sounds are emitted by the small speaker, called a tweeter.

These fundamental relationships hold true for all types of waves. As an example, for water waves, v_w is the speed of a surface wave; for sound, v_w is the speed of sound; and for visible light, v_w is the speed of light. The amplitude X is completely independent of the speed of propagation v_w and depends only on the amount of energy in the wave.

As we know that sore throat is the most recognised symptom of covid 19. And according to the recent research we have found that because of sore throat voice started changing. We have analysed that because of sore throat loudness and frequency of a person started becoming low than the normal voice. We can easily understand this by above speakers figure again.



Relationship between **zero crossing** and **frequency**: -



From above figure we can understand,

$$f \propto \text{zero crossing}$$

When we record voice with a fixed sampling rate (by default 48kHz) for a fixed interval of time Z.

$$\text{Data samples} = \text{Sampling rate} \times Z$$

Audio processing: -

When a person will record his/her voice with speaking English alphabet 'A' loudly for more than 5 seconds it will store in form of Data samples. We chose fix number of data samples from mid part of recorded audio and calculated zero crossings. After many tests and trials, we have found that for per 100 samples of that audio, zero crossings should we less than 6 for a normal voice and if zero crossings go more than 6, throats will be recognised as sore throats.

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