

Format Analysis of Speech Signals

Submitter:

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150002025 | 150002028 | 150002018

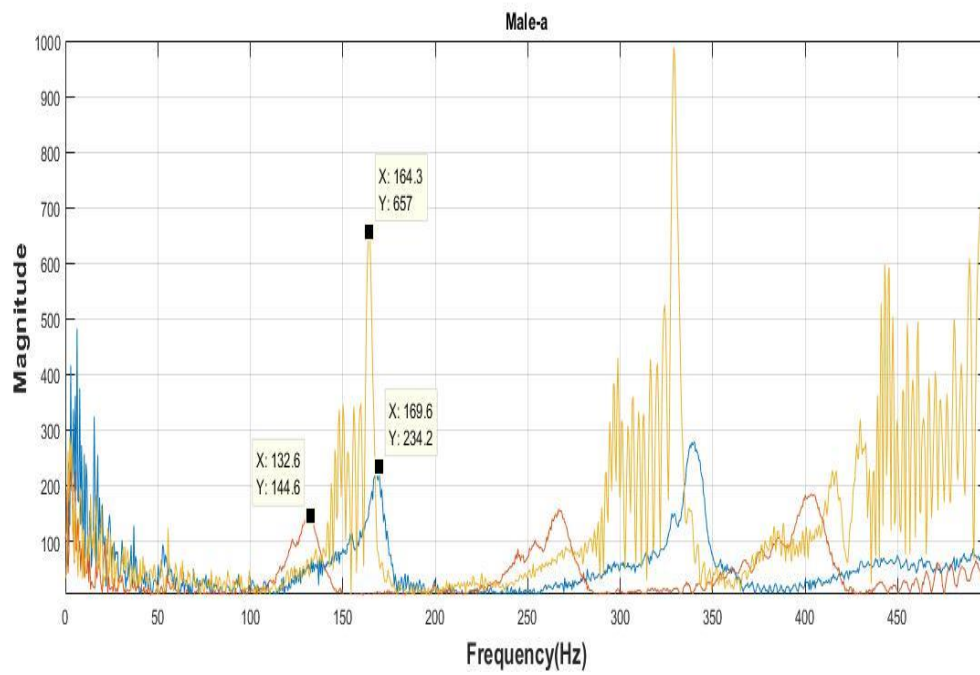
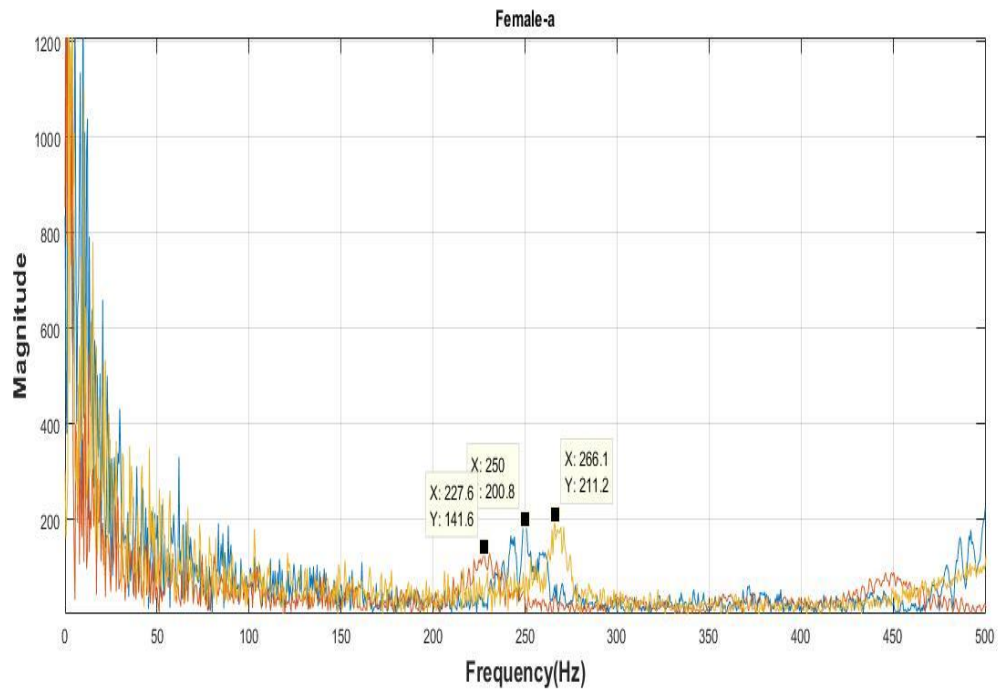
Abstract

The project was based on the inspiration to scientifically study the speech signals and analyze them to give important observations and inferences accumulated through the process. A normal human speech is not composed of a single frequency but a collection of multiple frequencies, the vowels in English are most commonly used in speech. A more clear comparison can be obtained by analyzing a simple vowel sound rather a complete speech, it's for this reason the voice samples composed of vowels. The signal samples were taken from both the male and female volunteers. The voice samples were all 2 second samples and each volunteer was made to pronounce vowels (namely a, e, i, o and u). The graphical analysis reveals that there is a difference between the dominant frequency for male and female volunteers, but there was a difference as to how the alphabets were pronounced within the same category. The revelations are listed further in the discussion.

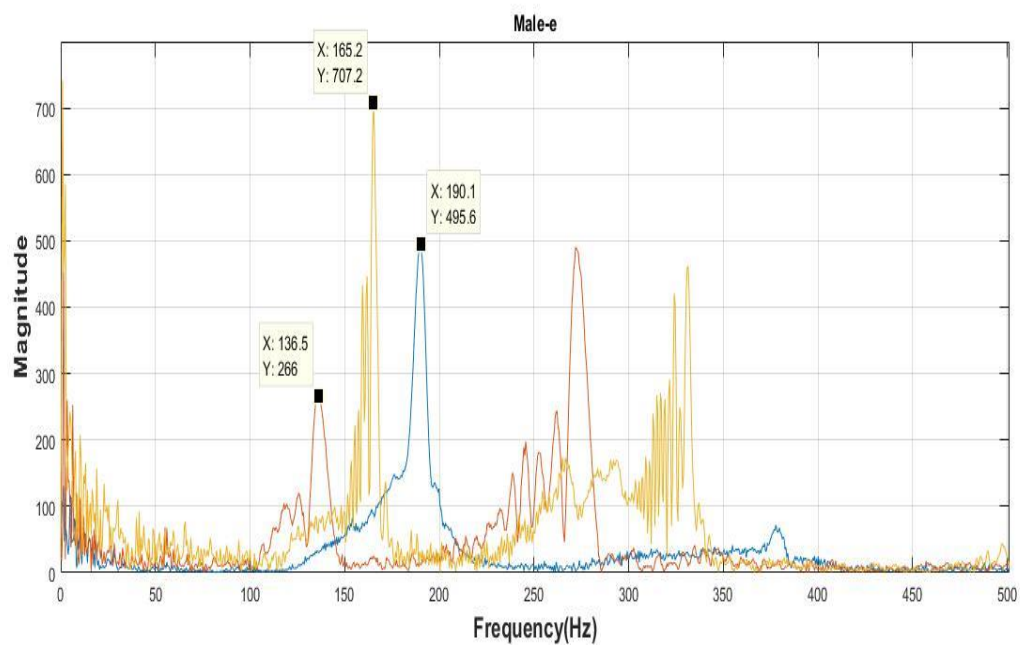
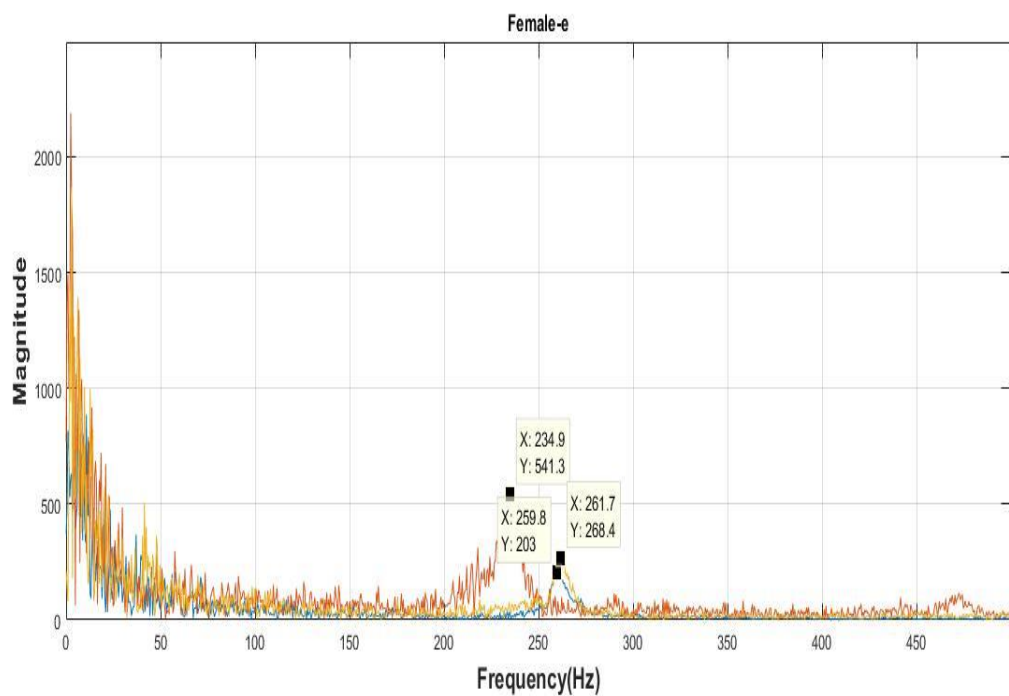
Material and Method

The project required multiple voice samples both from male and female volunteer. The samples were taken from the age-group of 18-21 year students. There are three samples in each category of male and female. The speech signals' Fourier transform was used to plot the spectral distribution for various frequencies.

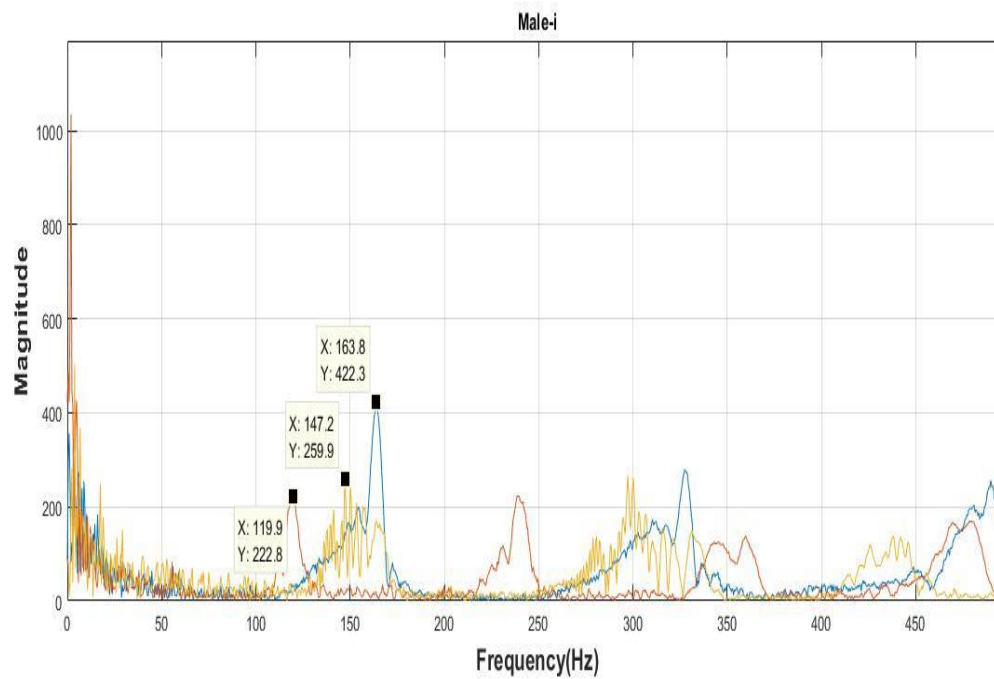
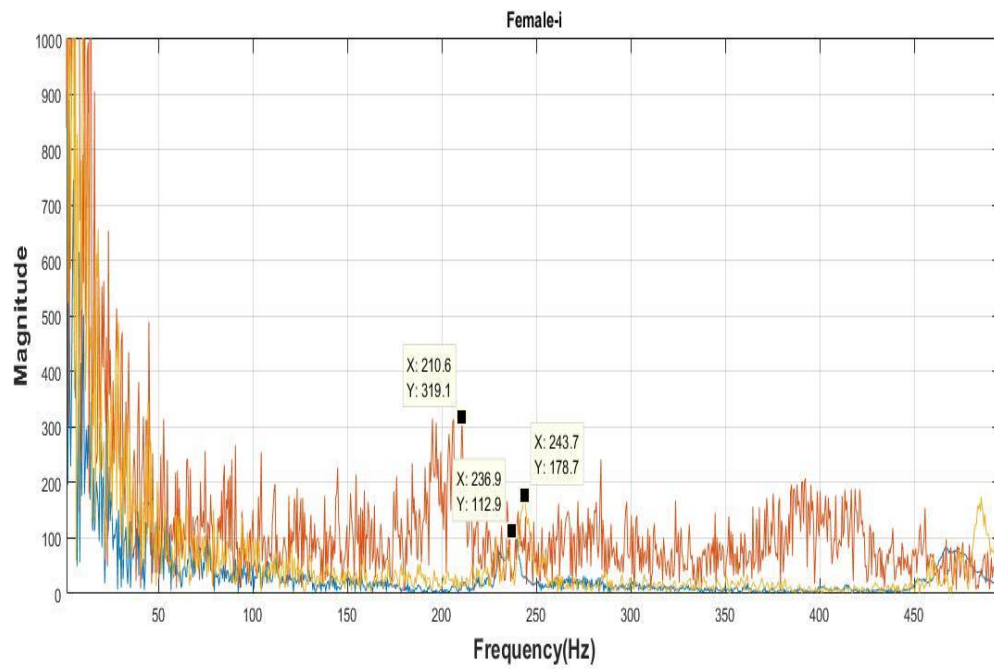
In analyzing the plots it was well taken in precaution that normal speech frequency lies within 350Hz, thus all the peaks in the plots are marked for the range within 350Hz. It was convenient to show all plots within same category as a single plot rather than different plots for east comparison. The plot for each vowel is shown and the data points are also marked for peaks. The average frequency is then calculated by averaging the frequency in each category for final comparison.



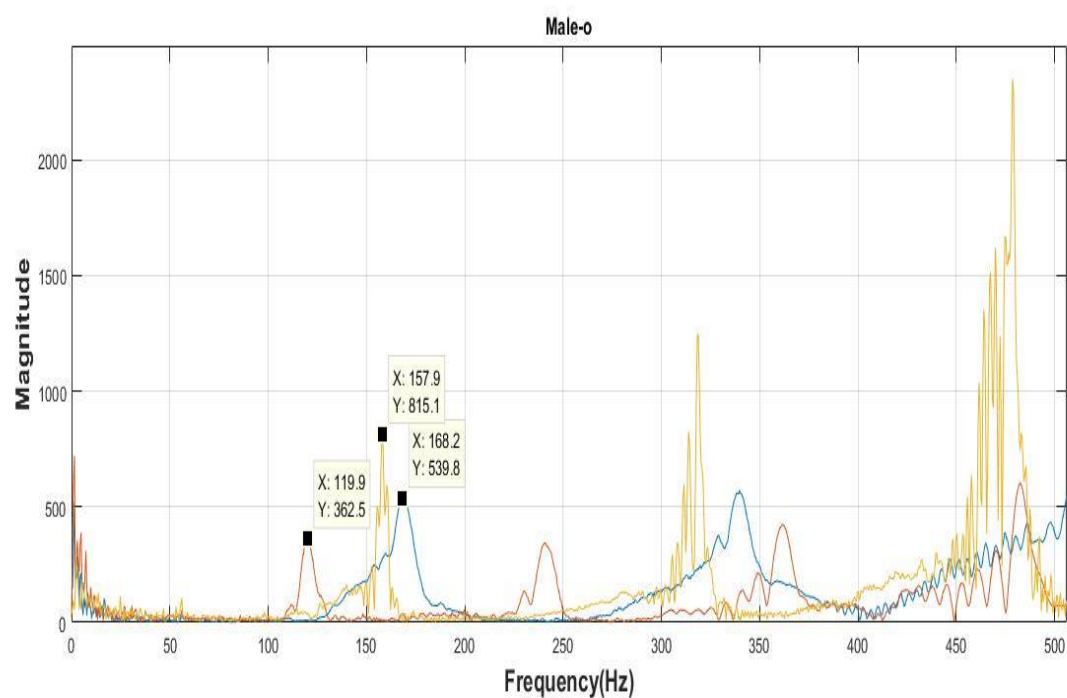
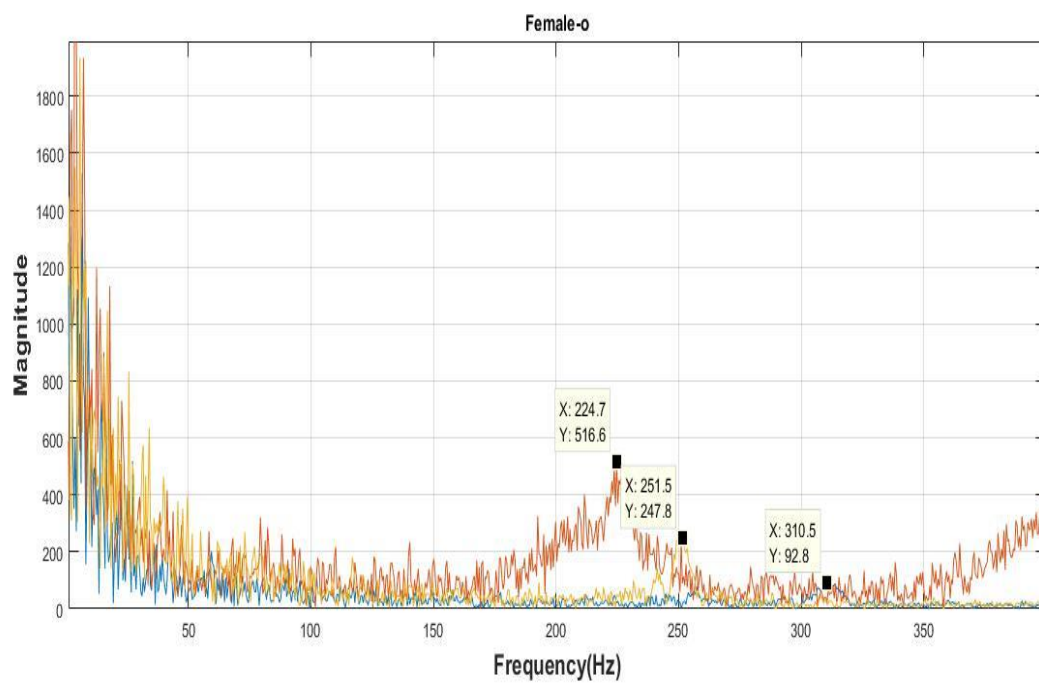
Comparisons between male and female voice samples for vowel-a



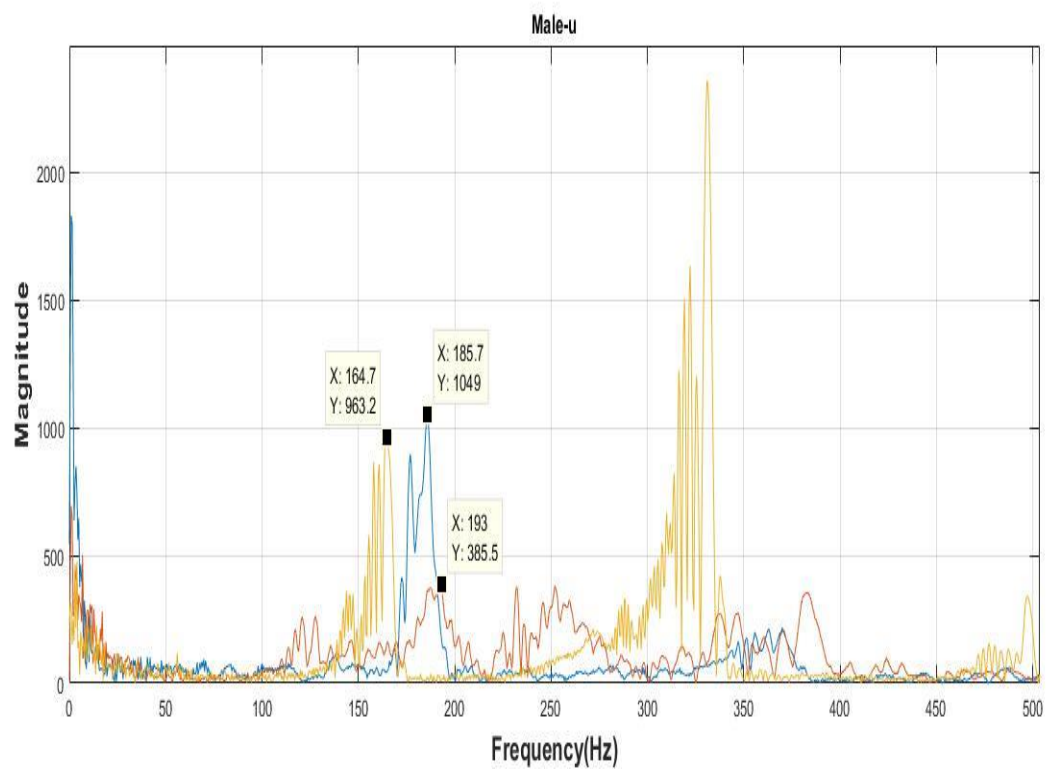
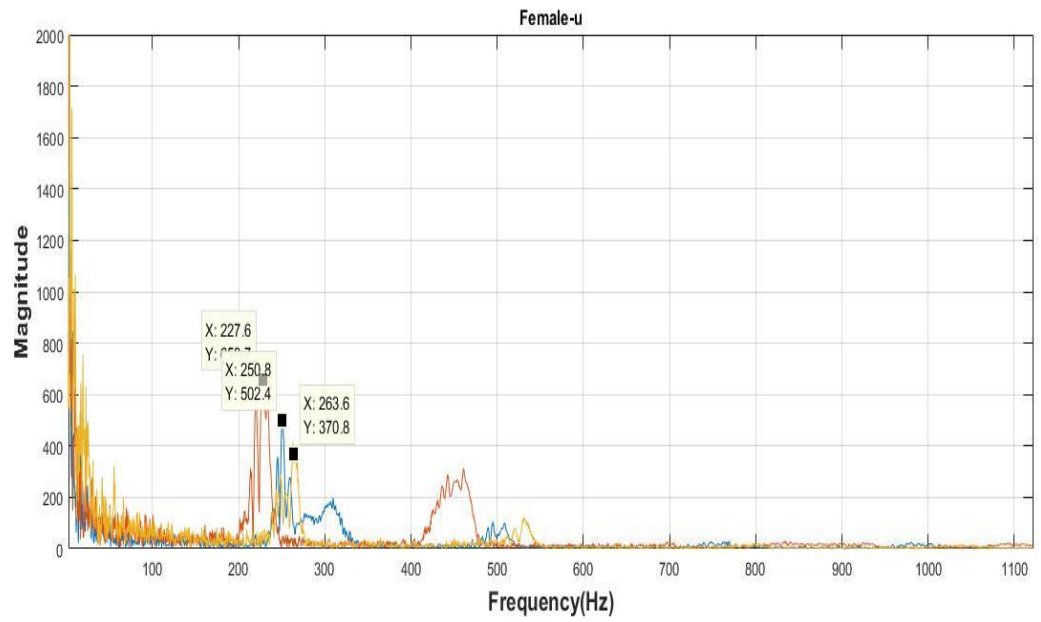
Comparisons between male and female voice samples for vowel-e



Comparisons between male and female voice samples for vowel-i



Comparisons between male and female voice samples for vowel-o



Comparisons between male and female voice samples for vowel-u

Tabulated Frequency Data:

<i>Vowel</i>	a	e	i	o	u
<i>Volunteer-1</i>	132.6	136.5	119.9	119.9	164.7
<i>Volunteer-2</i>	164.3	165.2	147.2	157.9	185.7
<i>Volunteer-3</i>	169.6	190.1	163.8	168.2	193
<i>Average Frequency</i>	155.5	163.9	143.6	148.7	181.1

Table1: Showing average frequency (in Hz) of Male volunteers for every vowel they pronounce

<i>Vowel</i>	a	e	i	o	u
<i>Volunteer-1</i>	227.6	259.8	210.6	224.7	227.6
<i>Volunteer-2</i>	250.0	234.9	236.9	251.5	250.8
<i>Volunteer-3</i>	266.1	261.7	243.7	310.5	263.6
<i>Average Frequency</i>	247.9	252.1	230.4	262.2	247.3

Table2: Showing average frequency (in Hz) of Female volunteers for every vowel they pronounce

Conclusions:

The distribution clearly suggests that in age group of 18-21 the female voice is of higher frequency. Females have high pitched voice. The highest frequency in male distribution was not even close to that of lowest frequency in female distribution. Among the vowels the vowel 'i' is pronounced with least frequency as compared to other vowels.

MATLAB Code:

```
>>[y,Fs] = audioread('E:\Project\Venky\u.mp3');
>>Y = fft(y);
>>l = length(Y);
>>Y = Y(1:l/2);
>>f = (0:l/2-1)*Fs/l;
>>Ym = abs(Y);
>>YY = smooth(Ym,'loess');
>>plot(f,YY); xlabel('Frequency(Hz)'); ylabel('Magnitude');
>>hold on

>>[y1,Fs1] = audioread('E:\Project\Levi\u.mp3');
>>Y1 = fft(y1);
>>l1 = length(Y1);
>>Y1 = Y1(1:l1/2);
>>f1 = (0:l1/2-1)*Fs1/l1;
>>Ym1 = abs(Y1);
>>YY1 = smooth(Ym1,'loess');
>>plot(f1,YY1); xlabel('Frequency(Hz)'); ylabel('Magnitude');
>>hold on

>>[y2,Fs2] = audioread('E:\Project\Pranjal\u.mp3');
>>Y2 = fft(y2);
>>l2 = length(Y2);
>>Y2 = Y2(1:l2/2);
>>f2 = (0:l2/2-1)*Fs2/l2;
>>Ym2 = abs(Y2);
>>YY2 = smooth(Ym2,'loess');
plot(f2,YY2); title('Male-u'); xlabel('Frequency(Hz)'); ylabel('Magnitude');
```