

Language Identification Using Acoustic Features of Speech Signal on Vowels of Assamese, Bengali and Bodo Languages

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ABSTRACT

The fundamental issue of the spoken language identification refers to the automatic process through which we determine or verify the identity of the language spoken in a speech sample. Human are born with the ability to discriminate between spoken languages as part of human intelligence. Here in this paper studies the various features of speech that are used for language identification. A comparative investigation on speech signal is made to identify various languages of both male and female using acoustic features, means the machine will identify what type of language a male or a female is saying.

Keywords: Acoustic features, pitch, formant, zero crossing, Energy.

INTRODUCTION

Human speech processing has been a goal of research for more than five decades and has inspired many researchers to work on it. Acoustic signal has many level of information like what is spoken, who is speaking, which language is speaking, emotions and gender information [1]. A human listener can easily identify what is talking, which language is using and approximate age and gender of speaker. These information are called voice information which can be described by different acoustic parameters. Information of speech remains in range from 200 Hz to 1 kHz. Female speak with higher fundamental frequencies than male [2]. This difference occurs due to physiological difference like vocal track thickness, length and speaking style [3]. However, gender classification between children and adolescents is a challenge because F0 and formant frequencies are not easily distinguishable between boys and girls [4].

MFCC and Delta MFCC are used to build model for gender and radial basis function network is used for classification in Multilanguage environment [1]. Formant, Pitch and their combination are used for gender classification by the author of [2]. Pitch has been extracted by Autocorrelation, Cepstrum and Average Magnitude Difference (AMDF) methods. Formants are calculated using LP model pole extraction method. Formant F1 and Pitch are used as parameter for gender detection in [3]. Mean value of both the parameters are calculated for male and female. By calculating nearest neighbour value with the help of Euclidean distance speaker was classified between male and female. Pitch is extracted by autocorrelation method for classification in [5]. A sufficient difference between average pitch value of male and female speech sample has been observed where female pitch value is higher than that of male. But in some cases pitch value of male become higher than that of female [6]. So authors of [6] used fuzzy logic and neural network for this purpose. A language independent and robust to noise gender classification system is designed using GMM in [7].

I. FEATURES

Feature is the vector of numbers which represent one time-slice of a speech signal [8]. A speech signal is a slowly time varying signal, when examined over a sufficiently short period of time, its characteristics are fairly stationary [9]. Therefore, speech signal is divided into frames of short-time duration by means of "windowing" technique for further processing.

Pitch

The Pitch of a sound is the perceptual correlate of frequency. If a sound has a higher frequency, it is perceived that it has higher pitch [8]. It is estimated by using short term autocorrelation function in time domain

Short time autocorrelation function:

Autocorrelation function is used to determine the unknown period of a quasi-periodic signal such as speech. The autocorrelation function for a delay value of K sample is

$$r(k) = \frac{1}{N} \sum_{n=0}^{N-1-k} x[n]x[n+k]$$
 This for a given frame of N samples of voiced speech, a plot of versus k would exhibit distinct peaks at k value of 0, p, 2p, ... where p is the pitch period. This pitch period for that frame is simply got by measuring the distance in samples between the peaks of the graph of the autocorrelation function.

Average Magnitude difference function

The AMDF is similar but opposite to the autocorrelation function.

For a delay of K samples, the AMDF is defined as,

$$D(k) = \frac{1}{N} \sum_{n=0}^{N-1-k} |x(n) - x(n+k)|$$

Formant

The resonances of the vocal tract are called formants [3]. There are several methods of formant extraction such as peak picking, HMM and LP model pole extraction. In this work formants are calculated using LP model pole extraction method. Formant F0 for adult males is typically around 120 Hz, while F0 for adult females is around 200 Hz [3].

Short time Energy

The short time energy of speech may be computed by dividing the speech signal into frames of N samples and computing the total squared values of the signal samples in each frame. Splitting the signal into frames can be achieved by multiplying the signal by a suitable window function $w(n)$ where $n = 0, 1, \dots, N-1$. Short-Time Energy of a speech signal is given by

$$E_n = \sum_{n=-\infty}^{\infty} [x(n)w(n)]^2$$

$$W(n) = [0 \leq n \leq N-1]$$

Zero Crossing

The ZCR is the ratio of number of time domain zero crossings occurred to the frame length [6]. The authors of [6] found that the ZCR for female speech is higher than that of the male speech. The short time ZC is calculated for a block of N samples of speech as

$$ZCC = \sum_{k=1}^{N-1} 0.5 | \text{sign}(s[k]) - \text{sign}(s[k-1]) |$$

II. EXPERIMENT

For training and testing, the vowels of Assamese, Bengali and Bodo languages are recorded from 9 different male and 9 different female speakers respectively. For recording the speech signal, PC headset and sound recording software Gold wave is used and for data collection Praat Version 6.0.15 is used. Sampling Frequency is 96000Hz, Channels is 2stereo. The raw samples are the speech recording, captured with male-female gender and mood variations uttering the vowels of Assamese, Bengali and Bodo languages. The work involves collection of speech samples and designs the system for testing. The primary objective is to develop a speech recognition system which has language specific applications. The present work provides the basic frame work of a model which can be extended to that objective.

We collected some wave files for Assamese vowels for both males and females, Bengali vowels for both males and females and Bodo vowels for both males and females. Now we have tested this wave files with the help of Matlab Programming to find acoustic features- Pitch, Formant, Zero crossing count and energy.

PITCH OF ASSAMESE, BANGALI AND BODO VOWELS OF FEMALE AND FEMALES

Detection of Pitch using Matlab

Pitch Assamese vowels of female

Pitch of Assamese vowels of male

Name										
Bapan	137.14	123.23	144.79	185.32	154.83	189.34	110.72	124.03	107.50	119.85
Subhankar	156.35	177.44	200	200.41	195.51	223.77	170.51	183.55	168.71	184.26
Prosun	162.43	157.11	166.66	168.71	178.10	169.91	170.51	167.24	169.61	162.71
Biswajit	138.32	158.15	170.81	176.79	175.82	178.77	166.09	169.01	168.12	174.54
Rajib	154.34	149.3	172.97	173.91	182.85	187.5	167.83	174.54	170.51	179.77
Saurabh	150.70	149.53	161.88	166.09	166.09	209.60	155.33	154.83	154.09	174.86
Bhriugu	500	438.35	168.12	191.61	152.62	182.50	67.60	126.14	132.96	136.36
Mithinga	500	261.58	268.15	279.88	137.14	130.43	500	128	130.08	127.65
Raja Bodo	133.70	129.90	143.71	144.57	142.43	152.38	138.12	142.01	138.72	139.73
Average	225.88	193.84	177.45	187.48	165.04	180.47	182.97	152.15	148.92	155.52

Pitch Bengali vowels of female

Name										
Pallavi	248.70	241.20	274.28	280.70	274.28	313.72	269.66	274.28	266.66	268.15
Sujata	246.15	241.20	277.45	290.90	279.06	294.47	248.70	279.06	255.31	260.86
Moushumi	246.78	244.27	304.76	325.42	307.69	352.94	268.90	293.57	261.58	267.40
Mamata	223.77	219.67	225.88	241.20	241.20	249.3	228.57	226.41	225.35	227.48
Samaina	226.9	234.14	237.03	248.06	238.80	260.86	233.57	235.87	238.80	238.21
Jasmine	229.66	218.67	240	249.35	249.35	265.92	230.76	244.89	231.32	231.32
Doly	250.65	234.71	248.70	256.68	265.19	251.69	246.78	248.06	250	252.63
Lonee	249.35	242.42	293.57	292.68	281.52	297.21	250	246.15	240	242.42
Sikha Moni	222.22	210.52	235.29	241.20	234.14	243.65	231.32	245.52	231.88	232.14
Average	238.25	231.87	259.66	269.58	263.47	281.12	245.36	254.87	244.54	246.96

Pitch Bengali vowels of male

Name										
Bapan	470.58	117.35	130.61	172.97	155.33	176.4	133.70	136.55	117.35	120
Subhankar	146.34	148.14	151.41	168.71	162.16	198.34	170.51	172.35	150.23	18.79
Prosun	147.01	137.53	158.67	168.12	349.09	178.10	166.95	161.34	161.61	157.37
Biswajit	147.46	148.37	170.21	190.09	179.77	190.85	161.61	170.21	172.66	176.47
Rajib	155.84	146.11	170.21	181.47	168.42	174.22	158.41	159.73	166.66	160.26
Saurabh	159.20	154.58	181.81	206.89	169.01	188.60	159.73	173.59	168.71	174.54
Bhriugu	137.73	107.86	176.14	159.20	142.01	175.18	124.35	138.32	129.38	134.45
Mithinga	130.79	430.49	126.14	290.03	147.01	148.14	500	134.51	134.26	147.23
Raja Bodo	440.36	127.82	137.93	160.26	147.46	157.11	140.35	138.12	134.26	140.96
Average	215.03	168.70	155.90	188.64	180.03	176.34	190.62	153.85	148.06	154.67

Pitch Bodo vowels of female

Name	अ	आ	इ	उ	ए	ओ
Pallavi	256	259.45	273.50	295.38	274.28	268.15
Sujata	246.78	244.89	278.26	278.26	264.46	252.63
Moushumi	260.16	238.80	273.50	289.15	260.86	268.15
Mamata	219.67	204.69	228.02	236.45	210.98	222.22
Samaina	229.11	225.35	230.21	232.14	223.77	233.57
Jasmine	222.22	211.92	240	233.57	229.11	223.25
Doly	240.60	237.03	231.32	250	234.14	251.30
Lonee	249.35	240	283.18	278.26	255.31	242.42
Sikha Moni	226.95	216.21	246.15	246.15	233.00	233.00
Average	238.98	230.93	253.79	260.15	242.88	243.85

Pitch Bodo vowels of male

Name	अ	आ	इ	उ	ए	ओ
Bapan	116.78	116.36	132.04	143.92	123.55	122.60
Subhankar	168.71	169.91	186.40	191.23	154.83	500
Prosun	162.98	157.89	166.37	172.97	169.61	158.67
Biswajit	158.94	166.37	182.85	182.16	180.45	181.47
Rajib	155.08	151.65	172.97	174.22	158.15	158.15
Saurabh	159.46	396.69	170.51	174.54	156.09	173.91
Bhriugu	127.82	251.96	149.06	161.61	138.52	147.46
Mithinga	66.94	141.80	137.33	129.38	500	129.38
Raja Bodo	144.36	120.75	146.34	147.23	139.94	136.55
Average	140.12	185.93	160.43	164.14	191.24	189.80

SOCIAL FORESTRY AND AGRO FORESTRY: PAST TRIUMPHS AND FUTURE HORIZONS

We have calculated the averages of pitch of all the vowels of three languages of females and males by using Matlab programming on the above tables and from the study we see that, the averages of all three languages of vowels we can analyse that we cannot identify language with the help of acoustic features of speech.

Detection of formants

Formant of Assamese vowels of female

Name										
Pallavi	519.80	518.05	518.29	518.41	518.87	520.81	561.76	517.87	518.16	519.52
Sujata	840.3	1008.62	313.84	307.94	354.84	379.22	489.13	621.66	761.30	609.99
Moushumi	724.49	932.48	360.03	392.77	486.65	318.71	520.62	520.62	540.36	607.26
Mamata	498.71	977.43	284.04	285.00	430.07	400.30	442.5	502.67	416.46	497.79
Samaina	646.00	928.82	345.07	384.92	416.96	415.60	543.19	580.62	548.17	516.57
Jasmine	541.16	713.8	375.8	321.7	391.32	434.40	475.58	432.74	476.54	523.54
Doly	651.36	940.63	377.08	512.72	463.00	461.54	480.37	477.80	542.93	559.97
Lonee	787.51	1011.10	325.53	334.61	657.83	657.83	780.79	659.10	600.25	509.62
Sikha Moni	683.23	929.24	376.01	361.10	446.08	468.37	453.04	501.69	472.11	518.58
Average	654.74	884.46	363.97	379.91	462.85	450.75	527.45	534.98	541.81	540.32

Formant of Assamese vowels of male

Name										
Bapan	505.54	904.39	288.60	516.13	362.96	312.03	417.14	430.43	448.03	434.35
Subhankar	617.41	888.86	349.69	298.22	307.39	318.46	375.57	670.47	467.22	400.15
Prosun	513.50	705.71	337.43	329.55	358.63	359.43	449.15	435.93	477.07	539.46
Biswajit	630.92	819.15	308.36	292.62	385.89	405.89	400.26	673.40	509.52	488.85
Rajib	449.89	719.30	293.45	329.78	372.36	401.88	539.63	411.89	541.50	435.86
Saurabh	636.01	854.88	375.46	419.5	515.97	373.19	364.55	485.38	564.71	407.18
Bhriugu	564.48	889.88	305.96	298.85	400.08	387.89	482.33	484.47	480.31	438
Mithinga	600.05	784.75	336.71	309.18	350.81	395.04	548.80	507.61	521.88	465.33
Raja Bodo	488.15	738.63	354.54	311.31	372.87	367.06	393.22	507.78	449.68	438.66
Average	556.22	811.73	327.80	345.02	380.77	368.99	441.18	511.93	495.55	449.76

Formate of Bengali Vowels of female

Name										
Pallavi	761.07	843.42	358.27	374.18	394.60	403.91	521.09	597.90	532.58	522.70
Sujata	775.52	860.25	312.70	355.98	315.79	392.98	480.1	561.83	514.49	558.45
Moushumi	681.74	681.74	393.23	372.34	449.67	451.91	503.56	553.06	545.10	527.33
Mamata	615.21	893.21	316.22	316.22	439.61	435.38	445.89	474.73	531.55	494.22
Samaina	548.63	871.94	334.1	354.63	505.58	413.05	461.25	517.88	498.13	558.88
Jasmine	523.60	830.39	339.51	355.65	505.04	412.46	461.20	542.24	502.05	559.67
Doly	626.17	933.08	418.98	363.63	503.95	466.39	491.26	494.86	498.90	507.65
Lonee	857.87	915.98	499.3	387.33	437.17	595.13	519.92	579.48	542.10	549.60
Sikha Moni	724.16	1031.18	355.65	394.00	419.46	428.63	473.06	577.77	440.854	510.23
Average	679.33	873.47	369.78	363.77	441.21	444.43	484.15	544.41	511.75	532.08

Formate of Bengali Vowels of male:

Name										
Bapan	631.95	811.86	465.16	308.84	370.15	403.86	408.54	479.79	479.77	435.92
Subhankar	596.81	796.64	330.41	272.17	359.78	329.73	372.39	370.57	431.59	368.23
Prosun	599.09	651.38	297.91	316.91	345.82	443.89	436.49	425.51	470.56	409.06
Biswajit	608.05	723.40	303.01	337.08	401.53	353.49	436.96	535.55	440.58	428.57
Rajib	444.08	770.82	305.86	299.99	255.38	328.42	486.45	501.83	461.59	417.58
Saurabh	611.53	920.15	354.53	368.89	374.14	363.60	362.07	440.97	443.35	406.47
Bhriugu	641.50	904.41	407.65	251.50	309.97	533.96	503.26	433.29	479.93	449.94
Mithinga	583.15	839.44	405.27	320.53	373.14	372.98	563.89	551.52	577.51	442.12
Raja Bodo	512.07	836.48	440.95	503.58	380.01	339.66	377.9	386.79	450.60	422.39
Average	580.91	806.06	367.86	331.06	352.21	385.51	438.66	458.43	470.61	420.03

Formate of Bodo Vowels of female

Name	ঐ	ঐ	ঐ	ঐ	ঐ	ঐ
Pallavi	859.35	939.05	377.96	630.17	506.11	736.90
Sujata	798.58	1020.82	316.81	380.82	505.76	538.32
Moushumi	719.28	956.87	312.74	418.74	495.18	591.03
Mamata	516.91	855.71	390.32	523.33	428.69	529.53
Samaina	546.04	1027.93	355.30	442.30	532.41	532.41
Jasmine	544.39	1018.33	416.02	483.33	458.43	559.22
Doly	700.58	897.26	409.45	463.88	441.67	653.92
Lonee	781.99	1040.78	330.58	367.35	605.64	677.48

Sikha Moni	225.80	215.81	245.62	245.12	217.37	231.61
Average	632.551	855.843	350.538	439.4542	465.6996	516.1624

Formate of Bodo Vowels of male

Name	अ	आ	इ	उ	ए	ओ
Bapan	616.458	855.386	294.742	367.599	539.212	527.504
Subhankar	562.147	795.963	352.143	361.833	361.68	513.841
Prosun	544.278	598.239	332.595	423.059	414.582	548.137
Biswajit	582.946	745.197	238.146	365.841	414.163	500.745
Rajib	617.165	754.506	333.17	340.288	470.833	444.036
Saurabh	641.335	820.746	344.812	314.423	381.393	536.777
Bhriugu	560.408	722.025	280.332	334.513	461.88	477.705
Mithinga	610.274	907.179	405.952	419.718	605.462	528.071
Raja Bodo	447.003	792.235	349.774	428.746	414.931	419.159
Average	575.779	776.8307	325.741	372.8911	451.5707	499.5528

We have calculated the averages of formant of all the vowels of three languages of females and males by using Matlab programming on the above tables and from the study we see that, the averages of all three languages of vowels we can analyse that we cannot identify language with the help of acoustic features of speech.

Detection of Zero-crossing using Matlab

Zero-crossing of Assamese vowels of females

Name	অ	আ	ই	ঈ	উ	ঊ	এ	ঐ	ও	ঔ
Pallavi	660	874.5	257.5	335	395	296	567.5	434	540.5	545
Sujata	900	650.5	335.5	302.5	356	386	536	569.5	782	731.5
Moushumi	640	898	307.5	462.5	292	423	504.5	441	392	583.5
Mamata	451.5	621.5	202.5	221	316.5	345.5	300.5	359	326.5	573
Samaina	498.5	432.5	145.5	151	217	368	531.5	463.5	333.5	279.5
Jasmine	319	661	206	135	214	342	348	285	292.5	432
Doly	321	449	232.5	230.5	362.5	437	266.5	366.5	617.5	400
Lonee	621.5	789.5	213.5	258	515	470.5	747.5	537.5	614	614
Sikha Moni	620.5	719	336.5	426.5	315.5	440.5	481	420.5	452	354
Average	559.11	677.27	248.55	280.22	331.5	389.83	475.88	430.72	483.38	501.38

Zerocrossing of Bengali vowels of females

Name	অ	আ	ই	ঈ	উ	ঊ	এ	ঐ	ও	ঔ
Pallavi	2015	2.34E+03	1098	2.43E+03	1.68E+03	1.71E+03	1466	1.69E+03	1.62E+03	1.69E+03
Sujata	1233	1460	790.5	1508	663	906	915	1431	993	1.22E+03
Moushumi	608.5	617	467.5	456.5	272.5	411.5	559	462	503	399
Mamata	524.5	706.5	217	850.5	321	294	238	294.5	380.5	313
Samaina	580	661	213	205.5	277.5	359	668.5	396	473	277.5
Jasmine	395.5	608	184.5	239.5	262	289.5	314	401	319.5	342
Doly	373.5	520	263.5	303	269	652.5	248	397	325.5	592
Lonee	602.5	668.5	367.5	656.5	412	557.5	565.5	565	494	569.5
Sikha Moni	538.5	467	137.5	184	296	312	312	478	286.5	434
Average	763.44	894.5	415.44	759.77	494.5	610.27	587.33	679.66	599.72	648.88

Zero-crossing of Bodo vowels of females

Name	अ	आ	इ	उ	ए	ओ
Pallavi	682	1145	271	529	598.5	846
Sujata	797	938	408	387	603.5	212.5
Moushumi	813.5	814.5	284.5	272	562	502.5
Mamata	417	599	370.5	246	405	326
Samaina	477	534.5	198.5	228	347	500
Jasmine	321	534	196.5	257	326	370
Doly	617	816.5	213.5	336.5	339.5	529.5
Lonee	681	968.5	172	278	692	603
Sikha Moni	522	407	280	211	306.5	379
Average	591.9444	750.7778	266.0556	304.9444	464.4444	474.2778

Zero-crossing of Assamese vowels of males

Name	অ	আ	ই	ঔ	উ	ঊ	এ	ঐ	ও	ঔ
Bapan	568.5	797	220	392.5	228	264.5	514.5	358	440	327.5
Subhankar	532	815.5	241	294	281	270	392	399	319.5	301
Prosun	406.5	706.5	163.5	177	166	332	355.5	242	304	307
Biswajit	529.5	827.5	219.5	380.5	266.5	327	508.5	639.5	516.5	399.5
Rajib	394	691	236	237	288	335.5	393	263	514.5	424
Saurabh	661	720	222.5	342.5	330	231	466	324	346	307.5
Bhriugu	432.5	499	224.5	219	247	279	427	391.5	337	313.5
Mithinga	503	757	265.5	325	229.5	290.5	448	325.5	390	434.5
Raja Boro	325.5	567	518.5	462	303.5	267.5	593	470	375.5	424.5
Average	483.61	708.94	256.77	314.38	259.94	288.55	455.27	379.16	393.66	359.88

Zero-crossing of Bengali vowels of males

Name	অ	আ	ই	ঔ	উ	ঊ	এ	ঐ	ও	ঔ
Bapan	506	476	623	293	268	234	721.5	383	395.5	449.5
Subhankar	438.5	756.5	221.5	199	256	224	469	225	419	306
Prosun	382.5	592	168	276.5	151	296	236.5	249.5	325	261.5
Biswajit	629.5	825	175	211	329.5	276.5	477.5	556.5	432	402.5
Rajib	398.5	712.5	140.5	292	209	271.5	159.5	334	332.5	267.5
Saurabh	610	864.5	327	675	276	300	446	351	379	350.5
Bhriugu	552	811.5	295	184.5	261.5	326	477	232	299	244.5
Mithinga	265.5	616.5	385.5	307	271.5	260	387	436	592.5	398.5
Raja Boro	488.5	745.5	463.5	640	322	291	637	351	385.5	323
Average	474.55	711.11	311	342	260.5	275.44	445.66	346.44	395.55	333.72

Zero-crossing of Bodo vowels of males

Name	अ	आ	इ	उ	ए	ओ
Bapan	637.5	858.5	243.5	197	814	470
Subhankar	436	615	200.5	246.5	499	589.5
Prosun	389	428.5	327.5	206.5	313	422
Biswajit	451.5	812	223	294.5	343	476

Rajib	631.5	861.5	304.5	278.5	485	458.5
Saurabh	797	908.5	272	263.5	542.5	513.5
Bhriugu	396	512	153	193.5	560.5	300
Mithinga	393	861	247	220	602.5	434.5
Raja Boro	333	465	481.5	252.5	714	347.5
Average	496.0556	702.4444	272.5	239.1667	541.5	445.7222

We have calculated the averages of zero crossing of all the vowels of three languages of females and males by using Matlab on the above tables and from the study we see that, the averages of all three languages of vowels we can analyse that we cannot identify language with the help of acoustic features of speech.

DETECTION OF ENERGY USING MATLAB

Energy of Assamese vowels of females

Name	অ	আ	ই	ঐ	উ	ঊ	এ	ঐ	ও	ঔ
Pallavi	0.011	0.0088	0.0183	0.0154	0.0148	0.0227	0.0109	0.0117	0.0133	0.0095
Sujata	0.0136	0.0114	0.0168	0.0252	0.015	0.0154	0.0142	0.0115	0.0106	0.0097
Moushumi	0.0116	0.011	0.0113	0.0162	0.0095	0.0154	0.0173	0.0125	0.0188	0.0122
Mamata	0.01	0.0093	0.0099	0.0108	0.0045	0.0131	0.0076	0.0117	0.0128	0.0123
Samaina	0.0102	0.0049	0.0201	0.0172	0.0098	0.0151	0.0123	0.0163	0.0106	0.0112
Jasmine	0.0073	0.0099	0.0117	0.0284	0.0066	0.013	0.0091	0.0125	0.0088	0.0114
Doly	0.008	0.0107	0.0123	0.0132	0.0126	0.0167	0.0129	0.0137	0.0177	0.0086
Lonee	0.0081	0.0082	0.013	0.0155	0.0114	0.0171	0.0101	0.0103	0.0122	0.0122
Sikha Moni	0.0065	0.0059	0.0128	0.0151	0.0132	0.0092	0.0108	0.0115	0.0111	0.0102
Average	0.0095	0.0089	0.0140	0.0174	0.0108	0.0153	0.0116	0.0124	0.0128	0.0108

Energy of Bengali vowels of females

Name	অ	আ	ই	ঐ	উ	ঊ	এ	ঐ	ও	ঔ
Pallavi	0.0099	0.0065	0.0112	0.0109	0.0111	0.0176	0.0101	0.0105	0.0113	0.0107
Sujata	0.0152	0.0137	0.027	0.0177	0.03	0.0244	0.0178	0.0111	0.0187	0.0138
Moushumi	0.011	0.0113	0.0153	0.017	0.0179	0.0161	0.0149	0.0121	0.0147	0.0154
Mamata	0.0064	0.0075	0.008	0.0062	0.0045	0.0125	0.0106	0.0109	0.0114	0.01
Samaina	0.0131	0.0075	0.0128	0.0142	0.013	0.0216	0.0125	0.0127	0.0139	0.015
Jasmine	0.0091	0.0079	0.0102	0.0141	0.0076	0.0141	0.0098	0.0136	0.0107	0.015
Doly	0.0058	0.0091	0.01	0.0134	0.0119	0.014	0.0161	0.0123	0.0218	0.0168
Lonee	0.009	0.0093	0.0118	0.0147	0.0114	0.0119	0.0093	0.0102	0.0093	0.0106
Sikha Moni	0.0058	0.0056	0.0132	0.0153	0.0114	0.0153	0.0123	0.0099	0.0125	0.0123
Average	0.0094	0.0087	0.0132	0.0137	0.0132	0.0163	0.0126	0.0114	0.0138	0.0132

Energy of Bodo vowels of females

Name	অ	আ	ই	ঊ	এ	ঔ
Pallavi	0.0104	0.0092	0.0178	0.0127	0.0113	0.0082
Sujata	0.0125	0.0106	0.0193	0.0208	0.0125	0.013
Moushumi	0.0129	0.0105	0.0123	0.0166	0.0131	0.0139
Mamata	0.0139	0.0101	0.0038	0.0091	0.0107	0.0134
Samaina	0.0087	0.0086	0.009	0.0143	0.0063	0.008
Jasmine	0.0088	0.0076	0.0176	0.0107	0.0116	0.011
Doly	0.0091	0.0095	0.0132	0.0121	0.0125	0.0106
Lonee	0.0091	0.0088	0.0043	0.0102	0.0086	0.0103

Sikha Moni	0.0071	0.0074	0.0161	0.0153	0.0166	0.0092
Average	0.010278	0.009144	0.0126	0.013533	0.011467	0.010844

Energy of Assamese vowels of males

Name	অ	আ	ই	ঐ	উ	ঊ	এ	ঐ	ও	ঔ
Bapan	0.0116	0.0087	0.0158	0.0167	0.0195	0.0208	0.012	0.0127	0.0149	0.0108
Subhankar	0.0094	0.0107	0.0166	0.0201	0.0172	0.0177	0.0137	0.0138	0.0141	0.0155
Prosun	0.0106	0.0089	0.0133	0.0151	0.0189	0.0192	0.0129	0.0153	0.0113	0.0107
Biswajit	0.0111	0.0084	0.0189	0.0197	0.0131	0.0188	0.0141	0.0126	0.013	0.0173
Rajib	0.0137	0.0135	0.0153	0.0165	0.0162	0.0215	0.0153	0.0191	0.0118	0.0189
Saurabh	0.0071	0.0105	0.0177	0.02	0.0181	0.0149	0.0127	0.0112	0.0124	0.0138
Bhriugu	0.012	0.0107	0.0186	0.0177	0.0146	0.0229	0.0122	0.0119	0.015	0.0158
Mithinga	0.0124	0.01	0.0128	0.0154	0.0133	0.0158	0.0162	0.0113	0.0118	0.0126
Raja Boro	0.0123	0.0063	0.01	0.0142	0.0176	0.0168	0.0075	0.0107	0.0148	0.0092
Average	0.0111	0.0097	0.0154	0.0172	0.0165	0.0187	0.0129	0.0131	0.0132	0.0138

Energy of Bengali vowels of males

Name	অ	আ	ই	ঐ	উ	ঊ	এ	ঐ	ও	ঔ
Bapan	0.0066	0.0071	0.0101	0.0184	0.0179	0.0178	0.0096	0.0119	0.0132	0.0089
Subhankar	0.0082	0.008	0.0077	0.0312	0.0134	0.0149	0.0128	0.0134	0.0103	0.0135
Prosun	0.0139	0.0073	0.0123	0.0141	0.0188	0.0154	0.0133	0.0128	0.0123	0.0098
Biswajit	0.0079	0.0077	0.0195	0.0214	0.0183	0.0188	0.0134	0.0133	0.0134	0.0147
Rajib	0.0209	0.0121	0.018	0.0255	0.0212	0.0178	0.0048	0.0145	0.0133	0.0139
Saurabh	0.0077	0.0075	0.0103	0.0125	0.0133	0.014	0.012	0.0157	0.0107	0.0162
Bhriugu	0.0099	0.0076	0.0161	0.0209	0.02	0.0169	0.0126	0.0157	0.0113	0.0133
Mithinga	0.0134	0.0087	0.0067	0.0161	0.0118	0.0144	0.0098	0.0155	0.0129	0.0139
Raja Boro	0.0121	0.007	0.0115	0.0192	0.0159	0.0225	0.0085	0.0146	0.0107	0.0131
Average	0.0111	0.0081	0.0124	0.0199	0.0167	0.0169	0.0107	0.0141	0.0120	0.0130

Energy of Bodo vowels of males

Name	অ	আ	ই	ঊ	এ	ঔ
Bapan	0.0111	0.0083	0.0141	0.0169	0.0065	0.0112
Subhankar	0.013	0.0111	0.0154	0.0145	0.0111	0.0118
Prosun	0.0104	0.0107	0.0126	0.0146	0.0121	0.0163
Biswajit	0.0107	0.0132	0.0235	0.0151	0.0143	0.0129
Rajib	0.0121	0.0112	0.0208	0.0178	0.015	0.0138
Saurabh	0.0079	0.0098	0.0136	0.016	0.0113	0.0096
Bhriugu	0.0147	0.0092	0.0173	0.0196	0.011	0.0141
Mithinga	0.0116	0.0093	0.0134	0.0096	0.007	0.0117
Raja Boro	0.0129	0.0077	0.0126	0.0175	0.0084	0.0112
Average	0.0116	0.010056	0.015922	0.015733	0.010744	0.012511

We have calculated the averages of energy of all the vowels of three languages of females and males by using Matlab on the above tables and from the study we see that, the averages of all three languages of vowels we can analyse that we cannot identify language with the help of acoustic features of speech.

CONCLUSION

In this paper we focused on language identification of speech signals using acoustic features, means the machine will identify what type of language a male or a female is saying. The acoustic features in this

project are analysed and tested through Matlab. We have collected pitch, formant, zero crossing and energy of various people and we can conclude that different people have different acoustic features, like they have different pitch, formant, zero crossing and energy in their speech. In this experiment, we have noticed that from vowel of any language we can identify the gender by calculating pitch value. But we have analysed that we cannot identify languages only with the help of acoustic feature of speech signal. Some more features are available to identify languages and we think with the help of those features we can identify languages. MFCC, and using other modelling techniques may be useful to identify languages.

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