Dialect detection of Apatani language of Arunachal Pradesh

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Abstract— the aim this paper to detect similar and dissimilar patterns of different Apatani dialects through extraction of relevant acoustic parameters such as pitch, formant analysis, Cepstral analysis. Considering all the linguistic and non linguistic features of the languages, it is expected that the study reveal some hidden characteristics of the languages which would strongly advocate its identity and uniqueness with respect to other tribal language of Arunachal Pradesh.

Keywords—Formant, Pitch, cepstral cofficients

I. INTRODUCTION

Apatani is one of major tribe of Arunachal Pradesh of North-East India. Apatani language spoken by around 60,000 people which contributes 2% of Total population of state of Arunachal, mostly natives of Ziro Plateau, in the Lower Subansiri district, papum pare and spread other district of Arunachal Pradesh also. Most of the previous researchers have done comparative-historical study of the Tani subgroup of Tibeto-Burman languages, As per report Sun (1993) describes Apatani as a relatively "aberrant" member of the subgroup, classifying it as an early-branching member of his Western Tani branch [1]. Indeed, a number of features mark Apatani as relatively special in the Tani context. At first, Apatani has a number of salient features which are rare or unique in Tani group[2], including contrastively nasalized vowels, a phonemic syllable-final glottal stop, and a voiceless velar fricative (*in* some dialects). While rare, since such features appear to be regular innovations, they tend to support Sun's early-branching hypothesis.

While all Apatani varieties are mutually-intelligible, there is a certain amount of internal variation, roughly correlated with the geographical clustering of villages in Ziro plateau. There are about five major Apatani varieties (some with relatively minor internal variation): moving clockwise from the north, these are (1) Bulla, spoken in the villages of Lempia, Reru, Tajang and Kalung, (2) Hari, spoken in Hari village, (3) Hong, spoken in Hong and Swro3 villages, (4) Dwbo, spoken in Swbe, Bwrw, Michi-Bamin and Mudang-Tage, and (5) Hija, spoken in the villages of Hija, Dutta and Nencalya. This paper is based on the Bulla, Hija, Hong of the northeastern corner of Ziro plateau of District Lower Subansiri in Arunachal Pradesh.

II. RELATED WORK

In the last two decades various researchers have attempted the identification tasks for numerous languages, dialects and accents and several techniques have been developed   Many of the techniques developed for language identification are directly relevant to the dialect and accent identification problems Language, dialect and accent identification has been a great challenge for a long time. In the last two decades various researchers have attempted these identification tasks for numerous languages, dialects and accents and several techniques have been developed. Approaches to language identification can roughly be divided into two groups: acoustic modelling, where spectral features of different languages are modelled directly; and phonotactic modelling, where speech is tokenised into phone strings and scored using different language models [3]. For a specifc language, dialect or accent, the most appropriate modelling technique is dictated mostly by the availability of data. . From the literature review we conclude that, for a specific language, dialect or accent, the most appropriate modelling technique is dictated mostly by the availability of data. If no transcribed speech data are available, acoustic modelling approaches seem most appropriate. If transcribed data for languages different from the target languages are available, approaches based on phone recognition followed by language modeling can be implemented. Where transcribed speech data for the target language are available, parallel phone or word recognition could be considered.

III. METHODOLOGY

The major tools used in the collection of data are human native speakers of the region. Multimedia PC equipped with software packages like Cool Pro Edit, capable of recording and playing sound signals is a tool used in studying a particular speech. a software package called Matlab is used for understanding the statistical analysis of speech signals
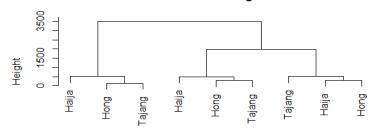
Word table taken for comparisons of three villages

SI.NO	APATANI WORD	Meaning in English			
1	Aai	blood	7	Ami	cat
		fruit			elder sis
		heavy			eye
		teeth	8	Apu	tail
2	Achi	coming			crowd
		pain			flower
		Sister in law	9	Ato	wrap
3	Ala	coming			come
		hand			grandfather
		soup	10	Hela	landlord
4	Alo	bone			dig
		day			understanding
		put down			is doing
		put to dry	12	Tado	rain
		salt			cutting
5	Alyi	coming			listening
		pig	13	Tapyo	heard first
		wind			sweet
6	Ama	communicable	14	Taru	ant
		mother			mosquito
		coming	15	Tayo	thread
					don't drink
					don't listen

Table 1.1: Formant Frequency Range database for Apatani Male and Female for Villages Hija, Hong and Tajang

Village-1: HIJA				
Formant frequency	Male		Female	
	Minimum	Maximum	Minimum	Maximum
F1	315.91	1839.61	426.58	2255.12
F2	1077.37	2743.82	856.44	2656.86
F3	1935.81	3806.53	1326.96	3342.77

Table 1.2

Village-2: Hong				
Formant frequency	Male		Female	
	Minimum	Maximum	Minimum	Maximum
F1	500.73	1940.87	608.70	2135.04
F2	1258.21	2764.12	1190.05	2981.84
F3	2067.59	3827.31	1761.41	3559.46

Table 1.3

Village-3: Tajang				
Formant frequency	Male		Female	
	Minimum	Maximum	Minimum	Maximum
F1	375.91	1724.65	518.43	1774.89
F2	1117.56	3008.94	1162.78	2904.79
F3	2193.73	3853.53	1731.31	3495.48

Cluster Dendrogram

distance
hclust (*, "complete")

IV. RESULTS AND DISCUSSION

After the observations and analysis of the data collected for both male and female from three different villages of Apatani region, it is observed that there is lots of tonal variations present in Apatani tribe ,hence depending upon the word with its different meanings the following conclusion can be drawn:

1.1 FORMANT FRQUENCIES

I. The formant frequencies of the 3 villages for both male and female have been shown in table. As shown in table it is found that the 1st formant and 2nd formant frequency for both male and female speakers from the Hong village is higher than the corresponding counterpart for the Hija and Tajang speakers[4]. Range can be shown as below:

II. i.e. $F1_{Hong} > F1_{Tajang} > F1_{Hija}$

$$F2_{Hong} > F2_{Tajang} > F2_{Hija}$$

III. The formant frequencies for female speakers seems always higher compare to the male speakers for all the Villages as shown in the given table no.

IV. From the given table for formant values for the word 'aai' it is observed that among the 4 meanings i.e. aai – blood, fruit, heavy, teeth the F3 value is maximum for the word heavy for both Hija and Tajang while in case of Hong the maximum value fall for F1 value, hence in this case Hong can be use as a distinguishing character for both the villages. Following are the ranges

$$HijaF3_{(3420.91)} > TajangF3_{(339.636)} > HongF3_{(3266.105)}$$

1.2 PITCH ANALYSIS

According to the table analysis, the range of variation of the pitch or fundamental frequency for both male and female speakers of the 3 villages, it is observed that the pitch of male speakers is higher then the female speakers of the regions. The following range is as shown below:

$$M_{Hija(705.11)} > M_{Tajang(487.33)} > M_{Hong(401.58)}$$
$$F_{Hija(512.25)} > F_{Tajang(393.449)} > F_{Hong(252.93)}$$
$$M\ (401.5772)\ >\ F(252.93)$$

It is further observed that pitch can be used for male to male identification. In case of female distinction is not clear. Thus the pitch can be taken as an important parameter for the identifications of the same sex within the same community or different[7].

1.3 CEPSTRAL ANALYSIS

In the present study, each digitized voice or word uttered is divided or blocked into 32 frames of 30.2msec duration. Each frame contains 250 samples and for each frame 20 cepstral coefficients have been calculated. The maximum and minimum value of the cepstral coefficients have been calculated the range of the coefficients is also calculated[8]. Hence by observing the data values for the male and female speakers we can get many distinguishing characteristics which will help us for further in depth study. The hierarchical Clustering(HAC) exhibit that more similar tone form the first cluster i.e Hong and Tajang followed by Hija merge together.

Hence in the present study many hidden parameters and features of the speech signals collected from different regions of Apatani plateau have been identified, by observing the data tables collected it is possible for us to go for further analysis, as we can see that the tonal properties of the speakers are highlighted in many different ways and hope this project will help to contribute some amount of information for the future studies.

V. CONCLUSION AND FUTURE SCOPE

After the observations and analysis of the data collected for both male and female from three different villages of Apatani region, it is observed that there is lots of tonal variations present in Apatani tribe, hence depending upon the word with its different meanings.

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