Automatic Speech Recognition of Rhotic Phonetic Class Words in Malayalam language

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Abstract - Diversity of phonetic realization is an important issue has been identified in speech recognition research. For most of literate languages, phonemes and letters in their scripts have varying degrees of correspondence. A given letter which is parallel across various languages may have different degrees of divergence in its phonetic realization in these languages. Hence in this paper we present speech recognition performance of rhotic class words of Malyalam language.

Keywords: Automatic speech recognition , Malayalam, rhotic class words.

I. INTRODUCTION

It is important that a perfect speech recognizer for a language should include all phonemes of the language in all word positions to incorporate maximum co-articulation effect. Hence our endeavor is to collect phonetic class wise words and develop speech recognizer for different phonetic classes Commonly, in the selection of text corpus for speech recognition, some phonemes never likely to occur and the words which includes such phonemes will never be recognized properly[1]. Therefore special care to be taken to include all phonemes of a language in maximum word positions(Start, end , middle). Our ultimate aim in this work is to develop a absolute speech recognizer for Malayalam Language[2]. Towards this objective in this paper we have chosen words in the above manner to include all phonemes of the language in all co-articulatory positions[3]. Thus this work will resolve co-articulation problem to some extent which is a superior challenge for a speech recognizer.

In this paper we discuss the results of the rhotic phonetic class speech recognition performance of Malayalam language. The words have been collected in such a way that, each word contains at least any of the phonemes of each class. Maximum care has been taken in the selection of words, so that all phonemes of the particular class occurred in all the word positions.

II. RHOTICS CLASS

In phonetics, rhotic consonants or "*R*-like" sounds, are consonants that are traditionally represented orthographically symbols derived from the Greek letter rho[4]. This class of sounds is difficult to characterize phonetically; from a phonetic standpoint, as there is no single articulatory [5] correlate common to rhotic consonants. Rhotics have instead been found to carry out similar phonological functions or to have certain similar phonological features across different languages. Although some have been found to share certain acoustic

peculiarities, such as a lowered third formant, further study has revealed that this does not hold true across different languages. Alveloar rhotic[6] is also called trill where as retroflex rhotic is known as flap. In Malayalam there is only one trill /r/ and one flap /r'/[7]

[r] Alveloar rhotic / trill occurs initially , and medially
Eg. /raan'i / -' a female name' , parava - 'small bird'
[r'] Retroflex rhotic / Alveolar flap / occurs initially and medially.
E.g. /kar'i/ 'charcoal' , /r'ipu/ 'enemy'

III. DATABASE DESIGN

We have collected words in such a way that each phoneme should occur in initial or , medial or final positions in the word. In all the positions the phonemes are succeeded by the maximum possible vowels. Position wise listing of number of words of each phoneme is detailed in table 1.

Table 1: Position wise listing of words

	Number of words with phonemes in			total
	Initial position	Medial position	Final position	
alveloar rhotic ര	11	10		21
retroflex rhotic റ	11	8	4	23
Total				44

IV. SPEECH RECOGNITION OF RHOTIC CLASS WORDS (WORDS HAVING RHOTIC CLASS PHONEMES)

A database of 43 words were carefully selected which include both rhotics (alvelor rhotic and retroflex rhotics) in all word positions (beginning , intervocalic , and end positions). Out of the total words, 23 words are alvelor rhotic words and 20 words are of retroflex rhotic words.

The table 2 shows the recognition results of rhotic class of words. Table 3 gives some of words of rhotic class with their pronunciation dictionary. We could achieve an average accuracy of 97.15% with the training data and 72% for the testing data.

Table 2: speech recognition result of words having rhotic class phonemes

Sl.No	Training	Testing
1	98.65	70.61
2	97	75.97
3	96	68.75
4	96.65	69.25
Average	97.15	71.96

Table 3 : Words having rhotic class phonemes and its pronunciation dictionary

r'ava	r' a v a	
r'aanni	r' aa nn i	
r'iya	r' i y a	
r'iin1a	r' ii n1 a	
r'uppi	r' u clp pp i	
r'uubi	r' uu vbb b i	
r'en1i	r' e n1 i	
r'e'ba	r' e' vbb b a	
r'ot't'i	r' o clt' t't' i	
r'o'sa	r' o' s a	
r'aina	r' ai n1 a	
taar'aavu'	clt t aa r' aa v u'	
mar'iyam'	m a r' i y a m	
mer'iin1a	m e r' ii n1 a	
mar'uku'	m a r' u clk k u'	
mar'a	m a r' a	
kar'i	clk k a r' i	
nir'am'	n i r' a m	
cho'r'u'	clch ch o' r' u'	
avar_	a v a r_	
ran't'u'	r a n' clt' t' u'	
raavile	r aa v i l e	
ripu	r i clp p u	
riiti	r ii clt t i	
ruchi	r u clch ch i	
ruupa	r uu clp p a	
rektam'	r e clk k clt t a m	
re'kha	r e' clk kh a	
rokkam'	r o clk kk a m	
ro'gam'	r o' vbg g a m	
raudr1'am'	r au vbd d r1' a m	
maran'am'	m a r a n' a m	
varaan_	v a r aa n_	
mariykkuka	m a r i y clk kk u clk k a	
mariichika	m a r ii clch ch i clk k a	
parukku'	clp p a r u clk kk u'	
kara	clk k a r a	
kari	clk k a r i	
kuru	clk k u r u	
pare'ta	clp p a r e' clt t a	
var'e	v a r' e	
chir'aku'	clch ch i r' a clk k u'	
paro'ksham'	clp p a r o' clk k sh a m	

V. SUMMARY

In this paper we presented a word recognizer for a particular class of Phonemes. This corpus can be claimed to be a phonetically balanced corpus and hence the recognizer would be appropriate for any type of applications as these words include all phonemes of the language in all word positions .

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