Interdisciplinary Journal of Linguistics
Volume [14] 2021, pp. 159-170

TEXT-TO-SPEECH CONVERTER FOR KASHMIRI: HANDLING VOWELS FROM GRAPHEME TO PHONEME

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Abstract

Natural Language Processing (NLP) provides the foundation for every Text-To-Speech system. This technology is of great help to many applications like telecommunication services, language education, and is of great benefit to physically impaired population (like visually and vocally challenged) as it reduces the dependency, frustration and sense of helplessness among them. The development of speech processing systems is more challenging as compared to text processing. Natural language processing is a major technology that can be used to bridge the gap between human communication and digital data. The goal of natural language processing is to design and build software that will analyze, understand, and generate languages that humans use naturally, so that eventually people can address computers as though they were addressing people. NLP has many applications such as Machine. Translation, Information Extraction, Summarization, Question Answering etc. In the last decade, most of the effort in this field is inclined towards machine translation. The objective of Kashmiri Text-To-Speech system is to generate an intelligible phonetic stream from Kashmiri text. Developing a Text-To-Speech system for Kashmiri will be of great help to those who can understand Kashmiri but cannot read and write.

Key Words: Graphology, Phonology, Natural Language Processing, Text-To-Speech

Introduction

As the term itself indicates, Text-To-Speech system is a phenomenon of transforming written words of any language into verbal form known as speech. It includes text processing and generation of sound waves by combining units of resonance.

1. **Text Processing:** Conversion of text into a concoction of components.
2. **Speech Production:** Generation of sound in accordance with the conglomerated components in a specific order.

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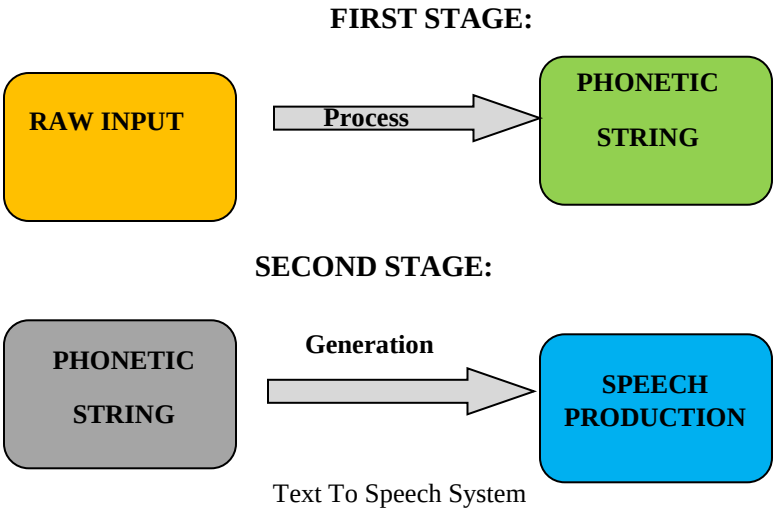

Text To Speech System

It is an analytical attempt to create Text-to-Speech system for Kashmiri language which includes Text-to-Speech equivalence in the form of allophones and phonemic rules. Developing Text-to-Speech converter for Kashmiri language following steps has to be followed.

1. A corpus of 10,000 words (Persio-Arabic or Kashmiri language) has been taken as representative input.

2. The input goes through transcription of Persio-Arabic into Romanization.

S.No	Persio-Arabic Script	Romanization
1.	اَکِس	AEkis
2.	اِنسانَس	AinsAAnas
3.	چھُ	cHhu
4.	پرٕپتھ	prvmYYtHh
5.	وزِ	Oizi

3. This Persio-Arabic script is also transcribed into Phonemic-set using International Phonetic Alphabet (IPA).

S.No	Persio-Arabic Script	Phonemic-Set
1.	اَکِس	əkis
2.	اِنسانَس	insaːnas
3.	چھُ	tʃʰu
4.	پرٕپتھ	pretʰ
5.	وزِ	Vizi

4. Both second and third steps are necessary to acquire phonemic equivalence between Romanized and Phonemic set.

S.No	Persio-Arabic Script	Romanization	Phonemic-Set	Phonemic Equivalence
1.	أکِس	AEkis	əkis	AE=ə k=k i=i s=s
2.	اِنسائَس	AinsAAnas	insa:nas	Ai=I n=n s=s AA=a: n=n a=a s=s
3.	چھُ	cHhu	tʃʰu	c=tʃ H=hʰ u=u
4.	پرٕتھ	prvmYYtHh	pretʰ	p=p rvm=r YY=e t=t Hh=ʰ
5.	وِزِ	oizi	Vizi	o=v i=i z=z i=i

5. Then, allophonic equivalence are drawn which reveals the placement of vowels and consonants in different forms and positions (Initial, Medial, Final).

	Allophonic Equivalence of Vowels	Allophonic Equivalence of Consonants
1.	/a/ a=A Initial a=e Medial a=a Medial	/p/ p=p Medial, Final
2.	/a:/ a:=AA Initial, Medial Final	/b/ b=b Medial, Final

6. It further gives way for the formation of phonological rules dealing with vowels and consonants.

	Rule for Vowel	**Rule for Consonant**
1.	/a/= A when it occurs at Initial position #---=A e.g., AkHh=ak^{h}	/p/ =p when it occurs at Initial position #---= p e.g., prvmYYtHh=pret^{h}

Vowels in Kashmiri

Vowels: Vowels are sounds articulated without a complete closure in the mouth or a degree of narrowing which would produce audible friction. Their duration in any word is most significant as they play a major role in pronunciation of a word. There are 16 vowels in Kashmiri language and are characterized on the basis of High, Mid, Low and Front, Central, Back categories as described in below table. Vowels can be described as short and long which in turn are oral or nasalized. Most vowels have nasal forms while length and nasalization are phonemic. We can describe vowels as short and long and their place of articulation as oral or nasalized. One can observe few of the vowels do not have their nasalized counterparts at phonemic level.

Middle	**Front** **Back**		
High **u** **u**:	**ii**:	**ɨ**	**ɨ**:
Mid **o** **o**:	**e** **e**:	**ə**	**ə**:
Low **ɔ** **ɔ**:		**a**	**a**:

(:**) Symbol for supra-segmental feature "Length".** Lengthening of phoneme in Kashmiri is phonemic.

Tables of Phonemic chart of vowels

Allophonic Equivalence of Vowels and Rules Derived (Reference: Vowels in phonemic chart)

Following is the table of annotations supporting illustrations:

#	Indicates word boundary.
___	Indicates placement of vowels
---	Indicates characters (Vowels or Consonants).

- High-front unrounded vowel **/i/** is observed as Ai, i
  - a. Ai → Placed at initial position.
  - b. i → Placed at medial and final positions.

- When the vowel /i/occurs at initial position of a word, it is observed as Ai. The formal notation of the same can be put as:

  Ai >i / __i_---#/

  Example: AinsAAnas = insaːnas(اِنسانَس)
- When the vowel /i/ occurs at medial position of a word, it is observed as i. The formal notation of the same can be put as:

  i>i / #---__i_---#/

  Example:oizi = vizi (وزِ)
- When the vowel /i/ occurs at final position of a word, it is observed as i. The formal notation of the same can be put as:

  i>i / #---_i__/

  Example: cHhi = tʃʰi (چھِ)

- High-front unrounded long vowel **/i**ː/ is observed as yii, y
  - a. yii → Placed at medial position.
  - b. y → Placed at final position.

- When the vowel /iː/occurs at medial position of a word, it is observed as yii. The formal notation of the same can be put as:

yii>iː / #---_iː__---#/

Example: tofyiiq = tofiːk (توفیق)

- When the vowel /iː/occurs at final position of a word, it is observed as y. The formal notation of the same can be put as:

y >iː /---__iː_#/

Example: pouuSSy = puːʃiː (پؤشی)

➢ High-central unrounded vowel **/ɨ/** is observed as I

a. I → Placed at medial and final positions.

- When the vowel /ɨ/ occurs at medial position of a word, it is observed as I. The formal notation of the same can be put as:

I>ɨ / #---_ɨ__---#/

Example: karInYY= karɨnʲ (کَرِنی)

- When the vowel /ɨ/ occurs at final position of a word, it is observed as I. The formal notation of the same can be put as:

I>ɨ / #---_ɨ__ /

Example: pEEdI= pəːdɨ (پأدِ)

➢ High-central unrounded long vowel **/ɨ**ː/ is observed as II

a. II → Placed at medial position.

- When the vowel /iː/ occurs at medial position of a word, it is observed as II. The formal notation of the same can be put as:

II>ɨ /#---_ɨ__---#/

Example: sIItYY= sɨːtʲ (سِتی)

- High-back rounded vowel **/u/** is observed as u

  a. u → Placed at medial and final positions.

- When the vowel /u/occurs at medial position of a word, it is seen as u. The formal notation of the same can be put as:

  u > u / #---__u_---#/

Example: gaCHhun = gatʃʰun (گژھُن)

- When the vowel /u/ occurs at final position of a word, it is seen as u. The formal notation of the same can be put as:

  u > u /---_u__#/

Example: cHhu = tʃʰu (چھُ)

- High-back rounded long vowel **/u**:/ is observed as ouu

  a. ouu→ Placed at medial position.

- When the vowel /u:/ occurs at medial position of a word, it is observed as ouu. The formal notation of the same can be put as:

  ouu> u: / #---_u:__---#/

  Example patlouun = patlu:n (پَتلوٗن)

- Mid-front unrounded vowel **/e/** is observed as e, YY, yv

  a. e → Placed at medial position.

  b. YY → Placed at medial position.

  c. yv → Placed at medial position.

- When the vowel /e/ occurs at medial position of a word, it is observed as e. The formal notation of the same can be put as:

  e > e / #---_e__---#/

  Example: nʲemtuk= nemtuk (نعمتُک)

- Furthermore, when the vowel /e/ occurs at medial position of a word, it is observed as YY. The formal

notation of the same can be put as:

YY > e / #---_e__---#/

Example: pYYTHh = peʈh (پیٹھ)

- /e/ vowel can also be observed as yv at medial position of a word. The formal notation of the

same can be put as:

yv> e / #---__e_---#/

Example: tyvlly = teli(تیلی)

➢ Mid-front unrounded long vowel **/e**:/ is observed as e:

a. e: → Placed at medial position.

- When the vowel /e:/ occurs at medial position of a word, it is seen as e:. The formal notation of the same can be put as:

y > e: / #---_e:__---#/

Example: rySS = re:ʃ (ریش)

➢ Mid-central unrounded vowel **/ə/** is observed as AE, E

a.AE → Placed at initial position.

b.E → Placed at medial position.

- When the vowel /ə / occurs at initial position of a word, it is observed as AE. The formal notation of the same can be put as:

AE > ə / __ə_---#/

Example: AEkis = əkis(أكِس)

- When the vowel /ə / occurs at medial position of a word, it is observed as E. The formal notation of the same can be put as:

E >ə / #---__ə_---#/

Example: sElyiiqhI = səli:kɨ (سَلِيقِہٕ)

➢ Mid-central unrounded long vowel /əː/ is observed as EE.

a. EE → Placed at medial position.

- When the vowel /əː/ occurs at medial position of a word, it is observed as EE. The formal notation of the same can be put as:

  əː > EE / #---_əː__--- #/

  Example: lEEgio = ləːgiv (لأگِو)

➢ Mid-back rounded vowel /o/ is observed asva, o, v

a. va → Placed at initial and medial positions.

b. o → Placed at medial position.

c. v → Placed at final position.

- When the vowel /o/ occurs at initial position of a word, it is seen as va . The formal notation of the same can be put as:

  o >va / va---# /

  Example: oanAAn = vanaːn (وَنان)

- When the vowel /o/ occurs at medial position of a word, it is observed as va . o >va / #---_va__---#/

  Example: banAAvan= banaːvan(بَناوَن)

- Again, when the vowel can be seen at medial position of a word it is observed as o. The formal notation of the same can be put as:

  o > o / #---_o__---#

  Example: moqhI= mokɨ (موقھٕ)

- When the vowel /o/ occurs at final position of a word, it is observed as v. The formal notation of the same can be put as:

  o> v / #---_v_/

  Example: AssrAAtao= asraːtav (اَسراتَو)

➢ Mid-back rounded long vowel /oː/ is observed as o

a. o → Placed at initial and medial positions.

- When the vowel /oː/ occurs at initial position of a word, it is observed as o. The formal notation of the same can be put as:

  Ao> oː / __oː_---#/

  Example: Aos = oːs (اوس)

- When the vowel /oː/ occurs at medial position of a word, it is observed as o. The formal notation of the same can be put as:

  o> oː / #---_o__---#/

  Example: kanTrol = kanʈroːl (کنڑول)

➢ Low-central unrounded vowel /a/ is observed as A, a, e

a. A → Placed at initial position.

b. a → Placed at medial position.

c. e → Placed at medial position .

- When the vowel /a/ occurs at initial position of a word, it is observed as a. The formal notation of the same can be put as:

  A > a / __a_---#/

  Example: AkHh = akʰ (اَکھ)

- When the vowel /a/occurs at medial position of a word, it is observed as a. The formal notation of the same can be put as:

  a > a / #---_a__---#/

  Example: pAAnas= paːnas (پانَس)

- Again, when the vowel /a/occurs at medial position of a word, it is observed as e. The formal notation of the same can be put as:

  a > e / #---_e__---#/

  Example: maharbEEny= meharbəːni (مَہَربأنی)

➢ Low-central unrounded long vowel /**a**:/ is observed as AA

a. AA → Placed at initial , medial, final positions.

- When the vowel /a:/occurs at initial position of a word, it is seen as AA. The formal notation of the same can be put as:

  AA > a: / _AA__---#

  Example: AAb= a:b (باَ)

- When the vowel /a:/occurs at medial position of a word, it is observed as AA. The formal notation of the same can be put as:

  AA > a: / #---__a:_---#/

  Example: AinsAAnas = insa:nas (انسانَس)

- When the vowel /a:/occurs at final position of a word, it is seen as AA. The formal notation of the same can be put as:

  AA> a: / #---_a:__---#

  Example: haYAA = haja: (حَيا)

➢ Low-back rounded vowel /**ɔ/** is observed as O

a. O → Placed at medial position .

- When the vowel /ɔ/occurs at medial position of a word, it is observed as O. The formal notation of the same can be put as:

  ɔ > O / #---_O__---#/

  Example: oOtHhun= vɔtʰun (وۄتُھن)

➢ Low-back rounded long vowel /**ɔ**:/

In Kashmiri Language, low back rounded long vowel /ɔ:/, is seen in only one word /sɔ:d/ ‘one and a quarter’, as a longer counterpart of the low-back vowel /ɔ/.

Discussion

Natural language processing is an important technique to overcome the language barriers. The focus of the present paper is on the graphology-phonology correspondence rules of Kashmiri vowels with reference to Text-To-Speech converter. The paper is part of building Kashmiri Text-To-speech System and has dealt with the graphology, phonology, correspondence for vowels in Kashmiri.

References

Allen, Jonathan, et al. *From text to speech: The MITalk system*. Cambridge UP, 1987.

Gupta, Shruti, and Parteek Kumar, *Hindi Text To Speech System*. 2012. Computer Science and Engineering Department, Thapar University, Patiala, ME Thesis.

Koul, Omkar N. "Kashmiri: A grammatical sketch." Ms., Indian Institute of Language Studies, Delhi, 2003.

Panzoo, Oveesa Farooq. *Comparative Study Of English And Kashmiri Phonology*. 2009. University of Kashmir, Srinagar, PhD dissertation.

Panzoo, Oveesa Farooq. *Kashmiri Phonetics And Phonology: A Study Based On Spoken Corpus*. 2013. University of Kashmir, Srinagar, PhD dissertation.

Thierry, D. *An Introduction to Text-To-Speech Synthesis*. New York: Kluwer Academic Publishers, 1997.