

11-712: NLP Lab Report

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Abstract

This is a report on the development of an open source dependency parser for the language, Bengali. Presently I have reported some basic information about the language.

The goal of this project is to design, implement and evaluate a dependency parser for the language, Bengali (also my native language). This language is characterized by a rich system of inflections, derivation and compound formation (Chakroborty, 2003; Saha et al., 2004) which makes analysis and generation of Bengali, a challenging task (Ghosh et al., 2009).

1 Basic Information about Bengali

According to (Lewis, 2013), Bengali is an eastern Indo-Aryan Language and is native to the region of eastern south Asia. It is the official language of Bangladesh and is also spoken in the Indian state of West Bengal and parts of Tripura and Assam.

Bengali follows the SOV order in terms of ordering of subject, object and verb (Dasgupta, 2003). It makes use of postpositions instead of prepositions. Determiners follow the noun while numerals, adjectives and possessors precede the noun. It exhibits no case or number agreement and no grammatical gender phenomena (Dasgupta, 2003). Nouns and pronouns are declined into four cases - nominative, objective, genitive and locative (Bhattacharya, 2001)

Bengali is written using the Bengali script. It has 11 vowel graphemes and 39 graphemes representing consonants and other modifiers. The script is written and read horizontally from left to right. Figure 1 and 2 show the vowels (and its various diacritics) and consonants in the Bengali script (Image source: Internet).

Figure 1: Vowels and vowel diacritics in Bengali script.

Vowels and vowel diacritics										
অ	আ	ই	ঈ	উ	ঊ	ঋ	এ	ঐ	ও	ঔ
a	ā	i	ī	u	ū	r̥	e	ai	o	au
[ɔ, ɒ]	[ɑː]	[i, e]	[iː]	[u, ɒ]	[uː]	[r̥]	[e, æ]	[oj]	[o]	[ow]
ক	কা	কি	কী	কু	কূ	ক্	কে	কৈ	কো	কৌ
ka	kā	ki	kī	ku	kū	k̐	ke	kai	ko	kau

2 Past work on Bengali dependency parsing

Some work has been done in building dependency parsers for Bengali. (Ghosh et al., 2009) have used a statistical CRF based model followed by a rule based post processing technique. (Nivre,

Figure 2: Consonants in Bengali script.

Consonants														
ক	ka	[kɔ]	খ	kha	[kʰɔ]	গ	ga	[gɔ]	ঘ	gha	[gʱɔ]	ঙ	ṅa	[ŋɔ]
চ	ca	[tʃɔ]	ছ	cha	[tʃʰɔ]	জ	ja	[dʒɔ]	ঝ	jha	[dʒʱɔ]	ঞ	ña	[ɲɔ]
ট	ta	[tɔ]	ঠ	tha	[tʰɔ]	ড	da	[dɔ]	ঢ	dha	[dʱɔ]	ণ	ṇa	[ɳɔ]
ত	ta	[tɔ]	থ	tha	[tʰɔ]	দ	da	[dɔ]	ধ	dha	[dʱɔ]	ন	na	[nɔ]
প	pa	[pɔ]	ফ	pha	[pʰɔ]	ব	ba	[bɔ]	ভ	bha	[bʱɔ]	ম	ma	[mɔ]
য	ya	[dʒɔ]	র	ra	[rɔ]	ল	la	[lɔ]						
শ	śa	[ʃɔ/sɔ]	ষ	ṣa	[ʃɔ]	স	sa	[ʃɔ/sɔ]	হ	ha	[ɦɔ]			
য়	ya	[jɔ]	ড়	ṛa	[rɔ]	ঢ়	ṛha	[rʰɔ]						

2009), (Ambati et al., 2009) used a transition based dependency parsing model based on MaltParser (Nivre and Hall, 2005). (De et al., 2009) uses a hybrid approach where they simplify the complex and compound sentential structures and then recombine the parses of the simpler structure by satisfying the demands of the verb groups. (Abhilash and Mannem, 2010) use a bidirectional parser with perceptron learning with rich context as features. (Kosaraju et al., 2010) used Maltparser and explored the effectiveness of local morphosyntactic features chunk features and automatic semantic information. (Attardi et al., 2010) used a transition based dependency shift reduce parser which used a Multi layer Perceptron classifier. They were all tested on the same dataset as a part of a shared task held at ICON 2009 and 2010. (Hussain, 2009; Hussain et al., 2010). In the 2009 contest, (Ambati et al., 2009) system performed the best and in 2010, best score of Unlabeled Attachment Accuracy was achieved by (Attardi et al., 2010) and the best scores for Label Accuracy and Labeled Attachment was achieved by (Kosaraju et al., 2010).

3 Existing useful resources for the task

Microsoft Research India has a POS tagged dataset for several Indian languages including Bengali. The bengali dataset has 899 POS tagged sentences. Also I have been able to gain access to the annotated dataset which was used in the shared task held at ICON 2009 and 2010. Although I am aware that I cannot use the annotated dataset, I am hopeful that it will provide important insights for annotation. The data was annotated using the Computational Paninian Grammar. (Bharati et al., 1995)

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