11-712: NLP Lab Report

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Abstract

This project concerns the creation of an open-source morphological analyzer for the Farsi (Persian) language. This morphological analyzer is being developed in a finite-state paradigm, using open-source tools such as FOMA, and the goal of the project is to return the lemma for the surface form of Farsi words. While there have been previous efforts to make a stemmer or lemmatizer for the Farsi language, this project aims to create a lemmatizer that can be easily integrated into a larger natural language processing system, for downstream applications such as syntactic dependency parsing.

1 Basic Information about Farsi

Farsi, also known as Persian, is an Indo-European language of the Indo-Iranian branch with over 100 million speakers. It is the official language of Iran, where it is called Farsi, as well as Afghanistan, where it is called Dari, and Tajikistan, where it is called Tajik. There are some differences between these three dialects, so this project will be primarily concerned with the language as written in Iran.

Farsi is an agglutinative language, meaning that most affixes correspond to one syntactic category. Farsi has a productive derivational morphology, creating new words using prefixes and suffixes which attach to word stems, as well as creating new words using compounding. Farsi nouns are marked for number, either singular or plural, and definiteness. Farsi does not have grammatical gender or case marking, except for one optional object case marker. Farsi verbs conjugate into past, present, and future tenses, with additional conjugations for progressive and perfective aspect, as well as subjunctive mood. Farsi is a pro-drop language, meaning pronouns are frequently ommitted from sentences, and the basic word order is Subject-Object-Verb (SOV).

The writing system for Farsi is the Persian alphabet, which is written from right-to-left. The Persian alphabet is based on the Arabic alphabet, with the addition of four letters to represent the sounds /p/,/tʃ/,/ʒ/,/g/, which do not exist in Arabic. The Persian alphabet is an abjad, meaning only consonants and long vowels are written. Letters join to one another, changing shape, with most letters have a beginning, middle, and final form, depending on where in the word the letter is written. Some morphemes do not join with the following letter in their word, in which case a space or a special zero-width-non-joiner character is placed in between the two morphemes.

2 Past Work on the Morphology of Farsi

Recent previous work on Farsi morphology includes the creation of two Farsi morphological resources. The first is a morphological lexicon for Persian, called PerLex (Sagot and Walther, 2010), which is freely-available online. PerLex consists of a mapping from Farsi lemmas to surface word

forms for several thousand words. The second is a stemmer for Persian, called Perstem (Jadidinejad et al., 2010), which is freely available online and is maintained by Jon Dehdari. Perstem is implemented in Perl and uses a romanization scheme and many complex regular expressions to create stems for Farsi words, suitable for information retrieval applications. Past work on Farsi morphology also includes a unification-based morphological analyzer by Megerdoomian (Megerdoomian, 2000) which was later adapted to a finite-state morphology paradigm (Megerdoomian, 2004).

3 Available Resources

The two freely-available Farsi morphology resources mentioned above, PerLex (Sagot and Walther, 2010) and Perstem (Jadidinejad et al., 2010), will be utilized in this project. PerLex will provide valuable examples of Farsi lemmas, as well as a mapping from these lemmas to surface words, which can be used to check the validity of the results of the morphological analyzer developed in this project. Perstem will also be useful as a tool for comparison with the morphological analyzer developed for this project, although the types of lemmas for this project may differ from the stems generated by Perstem.

The corpus for this project will be the Dadegan Persian Dependency Treebank (Rasooli et al., 2011), which contains 30,000 sentences of Farsi text. This corpus is in the format of the CONLL-X shared task for multilingual dependency parsing. The treebank contains gold-standard lemmas for each word in the treebank, which will be useful as a point of reference for this project. The data will be split into three sections: two smaller data sets for development and testing, and one larger data set for initial training. This dependency treebank is being used for this project because a secondary goal of this project is to integrate the resulting morphological analyzer into a larger NLP system, which includes a dependency parser trained on this treebank. For this reason, the lemmatization scheme for this project will follow the gold standard lemmas of the Dadegan treebank.

4 Survey of Phenomena in Farsi

Farsi text poses a challenge for morphological analysis, since the Persian alphabet has multiple forms for each letter and letters change forms when joining with their surrounding letters. Also, certain letter pairs are prevented from joining, for stylistic reasons, by the insertion of a space or zero-width-non-joiner character in between the pair. Because of these nuances of Farsi text, text normalization and processing will be the first priority of this morphological analysis project.

Derivational morphology in Farsi can be quite complex; a single verbal root can take many affixes which allow the word to become different nouns or adjectives. For example, the root of the verb "to know" can take suffixes that form the nouns "scientist, university, knowledge, wisdom" and the adjectives "scholarly, wise, ignorant". This is due to the agglutinative nature of the language. Recovering the original root of the word requires recognizing these many affixes.

Farsi verbs also pose a challenge for morphological analysis, since many verb conjugations include multiple space-separated parts, usually the present or past root of the verb, plus one or more auxiliary verbs. Morphological analysis of Farsi verbs will require recognizing both which part of a verbal conjugation is the main verb, and then both the past and present roots of the main verb will need to be returned as the lemmas.

Additionally, Farsi also makes use of many light verb constructions. These are comparable to English light verb constructions such as "take a bath", meaning "bathe", but many more Farsi verbs are of this type. For example, the verb for "to think" is composed of a noun + light verb pair which literally mean "thoughts" and "do". To create a lemma from such a light verb construction, the second part of the construction needs to be recognized as the verb and the lemmas for this verb need to be recovered from the surface form of the verb.

5 Initial Design

6 System Analysis on Corpus A

7 Lessons Learned and Revised Design

8 System Analysis on Corpus B

9 Final Revisions

10 Future Work

References

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