Universal dependencies for Uyghur

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Abstract

The Universal Dependencies (UD) Project seeks to build a cross-lingual studies of treebanks, linguistic structures and parsing. Its goal is to create a set of multilingual harmonized treebanks that are designed according to a universal annotation scheme. In this paper, we report on the conversion of the Uyghur dependency treebank to a UD version of the treebank which we term the Uyghur Universal Dependency Treebank (UyDT). We present the mapping of the Uyghur dependency treebank’s labelling scheme to the UD scheme, along with a clear description of the structural changes required in this conversion.

1 Introduction

Treebanks can be used for statistical learning as well as evaluation and are available for an increasing number of languages. For instances: Czech (Hajičová, 1998), Danish (Kromann, 2003), Turkish (Oflazer, 2003) Slovene (Džeroski et al., 2006), and Finnish (Haverinen et al., 2010). However, because of having been built with language-related specific schema, it leads to different treebanks with different structure. It seems reasonable, but this has hampered to perform sound comparative evaluations and cross-lingual learning experiments. It is reported that statistical parser output in one language cannot be easily compared or transferred to another when using two training data which labelled with different annotation schemes (McDonald et al., 2011; Søgaard, 2011). Mcdonald et al. (2013) reported improved results on cross-lingual transfer parsing using 10 uniformly annotated treebanks.

The Universal Dependencies (UD) seeks to develop cross-linguistically consistent treebank annotation guidelines and apply them to many languages to create treebank annotations, aiming to capture similarities as well as idiosyncrasies among typologically different languages, and released guideline to assist with the creation of new UD treebanks, or mapping and conversions of existing treebanks to a new universal scheme. The UD scheme is built on the Google Universal part-of-speech (POS) tagset (Petrov et al., 2012), the interset interlingua of morphosyntactic features (Zeman, 2008), and Stanford Dependencies (Tsarfaty, 2013; de Marneffe et al., 2014). In addition to the abstract annotation scheme, UD defines also a treebank storage format, CoNLL-U. The UD scheme accounts for varying linguistic differences across language by providing the option of defining language-specific label sub-types when the prescribed list of labels do not adequately cover all linguistic features of a given language. Nivre (2015) explains the motivation behind the project. Since then, a large number of additional treebanks have been either built or converted from existing treebanks to form new UD treebanks. To date, there are 54 treebanks representing 40 languages listed in the UD project.

We have mapped the Uyghur dependency Treebank (UyDT) (S.Mamitimin et al., 2013; M.Aili et al., 2016) to the UD scheme (Version 1) for purposes of cross-lingual studies and parser improvement. The UyDT is a corpus of Uyghur sentences that have been annotated manually. This paper summarizes the conversion and mapping of the UyDT to Uyghur Universal Dependency Treebank (UyUD), as part of the Universal Dependencies (UD) Project.

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2 Brief introduction for UyDT

Uyghur is a Ural-Altaic language, has rich and complex morphological structure. As a typical agglutinative language, Uyghur displays rather different characteristics compared to those more well-studied languages in the parsing literature. On the syntactic side, Uyghur has SOV constituent order, and considered a free-constituent order language. Uyghur is also a pro-drop language, as the subject can be elided if necessary, and recovered from the agreement markers on the verb.

We aim at building a dependency treebank to provide basic resources for future NLP researches. Morphological structure plays an important role in finding syntactic relations between words in Uyghur sentences. So all texts are morphologically analysed by Uyghur Morphological Analyser (UMA) software (M. Aili et al., 2012). There are 13 basic POS tags as shown in Table 1.

| No. | tags | POS     | No. | tags | POS     |
|-----|------|---------|-----|------|---------|
| 1   | N    | Noun    | 7   | I    | Imitative |
| 2   | A    | Adjective | 8   | C    | Conjunction |
| 3   | M    | Numeral | 9   | T    | Particle |
| 4   | Q    | Quantifier | 10  | E    | Exclamation |
| 5   | D    | Adverb | 11  | V    | Verb |
| 6   | P    | Pronoun | 12  | R    | Postposition |
| 7   | I    | Imitative | 13  | Y    | Punctuation |

Table 1. Basic Post Tags in Uyghur Languages

There are 23 dependency relations scheme in UyDT as general as possible which are listed in Table 2.

| No. | Label | Relations | No. | Label | Relations |
|-----|-------|-----------|-----|-------|-----------|
| 1   | ABL   | Ablative Adjunct | 13  | OBJ   | Object   |
| 2   | ATT   | Attributive Modifiers | 14  | POSS  | Possessor |
| 3   | ADV   | Adverbial Modifier | 15  | POST  | Postpositions |
| 4   | APPOS | Apposition | 16  | QUOT  | Quotation |
| 5   | AUX   | Auxiliary Verb | 17  | ROOT  | ROOT of Sentence |
| 6   | CLAS  | Classifier | 18  | PRED  | predicate |
| 7   | COLL  | Collocation | 19  | SUBJ  | Subject |
| 8   | CONJ  | Conjunction | 20  | CL    | Clause |
| 9   | COORD | Coordination | 21  | IND   | Independent component |
| 10  | DAT   | Dative Adjunct | 22  | COP   | Copula |
| 11  | INST  | Instrumental Adjuncts | 23  | COMP  | Comparison |
| 12  | LOC   | Locative Adjunct |

Table 2. Dependency relation tags in Uyghur Dependency Treebank

3 mapping

3.1 mapping POS-tagset

The UD part-of-speech (POS) tagset is an extension of The Google Universal POS tagset (Petrov et al., 2012) and contains 17 POS tags, whereas, in UyDT, there are only 13 POS tags. Fortunately, we could map most of them to Universal POS tags (e.g. N  Noun, A  ADJ).

However, only 10 POS tags in UyDT are mapped one by one to UD POS tags, six of the UD POS tags are not used, two tags in Uyghur POS tags are mapped to a same UD POS tag, as : (1) we didn’t identify auxiliary verbs in Uyghur which is actually a verb and called auxiliary verb only when combining with other substantive word and indicating a grammatical meaning; (2) In UyDT POS tagset, pronoun is also tagged as noun, as a result, PROPN in UD POS tags is also not used as well; (3) there are some discussion about DET, as there is not a tag called DET in Uyghur POS tagset, but some words have the meaning in a specific situation, which are numbers most of time. (4) Other three tags (SCONJ , SYM and X) are not used in UyDT. (5) According to the description of INTJ, two tags in
UyDT (exclamation and imitative) matched with it. We provide a mapping from the Uyghur POS tagset to the UD tagset in Table 3.

| UD  | UyDT POS | UD  | UyDT POS |
|-----|-----------|-----|----------|
| ADJ | A         | NUM | M        |
| ADV | D         | PART| T        |
| ADP | R         | PRON| P        |
| *   | Q         | PUNCT| Y       |
| CONJ| C         | VERB| V        |
| INTJ| E         | NOUN| N        |
| PROP| *         | X   | *        |
| AUX | *         | SYM | *        |
| SCONJ| *     | DET | *        |

**Table 3:** Mapping of the UyDT’s POS tagset to the UD’s POS tagset

### 3.2 mapping relations

UD defines a set of 40 broadly applicable dependency relations, further allowing language – specific subtypes of these to be defined to meet the needs of specific resources. However, there are only 23 types of dependent relations in UyDT. The conversion from UyDT dependency annotation to UD required not only relabelling types, but also changes to the tree structure, obviously, it isn’t a straightforward mappings. We use three steps to finish the conversing: rule based automatic label mappings; structural changes; manual checking. The details are as follows:

#### 3.2.1 rule based automatic label mapping

Most of the dependency relations which defined in UyDT are included in the UD, but isn’t one by one mapping. After comparing the Uyghur treebank relation description with UD description, we mapped Uyghur DT dependent relations to UD as following table. The relation ‘ATT’, for instance, could map to ‘acl, amod, det, nummod’, which of them should be chosen is another problem. To tackle with this problem, we settled priority and some limited rules on them according to our corpus features to choose one of them.

| Uyghur | Universal | Uyghur | Universal |
|--------|-----------|--------|-----------|
| ATT    | acl, amod, det, nummod | ADV    | advcl, advmod |
| CL     | advcl, parataxis | APPOS  | appos |
| AUX    | aux       | POST   | case |
| CONJ   | cc        | QUOT   | ccomp |
| COLL   | compound, mwe, list, name, nummod, goeswith | COORD  | conj |
| COP    | cop, neg  | PRED   | nsubj |
| IND    | discourse, parataxis, vocative | OBJ    | dobj, nmod:cau |
| LOC    | nmod     | DAT    | nmod |
| COMP   | nmod:comp | POSS   | nmod:poss, nmod:part, nmod:poss |
| LOC    | nmod:tmmod | SUBJ   | nsubj |

**Table 3** Mapping of the UyDT dependent relation to UD dependent relation
For example, the dependent relation ‘OBJ’ in UyDT could map to ‘dobj, dobj:cau, nmod:cau’ in UD, considering that the rate of using causative word is less than using non-causative word, we decided map all the dependent relation ‘OBJ’ to ‘dobj’; the dependent relation ‘ATT’ in UyDT could map to ‘acl, amod, det, nummod’. After adding some limitation on the dependent relation ‘ATT’, such as when the word is tagged ‘NOUN’, map it to ‘amod’, when it is tagged ‘NUM’ map it ‘amod’, and tagged ‘PRON’ map it to ‘det’. After rule based mapping, most of the dependent relations are transformed correctly, certainly including some wrong labels as well. Then, we manually checked and corrected them.

3.2.2 structural changes

The UD syntactic annotation is based on the universal Stanford Dependencies (SD) scheme (de Marneffe et al., 2014). One of the key properties of these schemes is that they emphasizes direct relation between content words, treating function words as dependents of content words rather than as their heads. However, it is not all the case in UyDT. Some function words such as copula or auxiliary words were head of the predicative, for when a copula or auxiliary attaching a word, it would indicate a grammatical meaning as well as get certain morphological forms. For example: ‘u hetni yezip boldi (he had written the letter); yezip bolghan hetni oqudi (he read the letter which had been written). In these examples, the word with bold font, generated from one stem bol, has different morphological form in each sentences to combine these words around it. Though it is auxiliary verb, produce relation ‘aux’ and marked as the head of the relation in UyDT. It contrasts with UD and needs to make some structural changes. We done this changes with manually, for structural changes were not easily automated. The following structural changes were made manually:

- aux & cop
  In the UyDT, the auxiliary and copula are treated similarly to a verb, and can function as the root of a sentence. However, the UD scheme analyses copula constructions differently: the predicate is regarded as the head of the phrase, and the auxiliary or copula is its dependent, as labelled by the ‘aux’ or ‘cop’. See Figure 1 (a) and (b) for comparison.

- punct
  In the UyDT, the punctuations which appeared in the sentence was not considered in dependent relation, instead, the last punctuation which appeared the end of a sentence was regarded as the head of the sentence and labelled as ‘ROOT’. However, the UD defines a punctuation depend on content word which it always attached to with the relation of ‘punct’ and can never have dependents. It is need to change the relation structure and the label of the relation ‘ROOT’ in UyDT. (Figure 1)

- conj & cc
  Significant changes were made to the analysis of coordination. In the UyDT, defined words which formed coordinate relations depended from begin to end relatedly and the last one was...
the head of them with the label of ‘COORD’. Meanwhile, the conjunction was depend on the coordinate word which it attached to with the label as ‘CONJ’ (Figure 2 (a)). The UD annotation scheme, on the other hand, uses right-adjunctions, where the first coordinate is the head of them, and the rest of phrase is adjoined to the right. We diverge from UD specification by marking the last conjunct as the head of the relation. All the other conjuncts depend on the last via labelling subsequent coordinates as ‘conj’ (Figure 2 (b))

![Diagram of Coordination Structure](image)

Figure 2: Coordination structure in the UD

3.2.3 Uyghur-specific relations

The UD scheme provides scope to include language-specific subtype labels. The label naming format is universal:extension, which ensures that the core UD relation remains identifiable, making it possible to revert to this coarse label for cross-lingual analysis. During the conversion of the UyDT, we defined some labels required to represent Uyghur syntax more concisely. These labels are discussed below:

- **advmod:emph**
  Some adverbial modifiers in Uyghur has served as the emphasizer or intensifier. We use the subtype label ‘advmod:emph’ in cases where modifiers emphasize or intensify their heads. It is also used in the Turkish, Ancient Greek, Arabic, Czech, Latin, Portuguese and Tamil scheme as well. (Figure 3)

![Diagram of UD advmod and advcl analysis](image)

Figure 3: UD advmod and advcl analysis

- **aux:q**
  It is used for conditional clauses. It is also used in Turkish scheme. (Figure 3)
In Uyghur, a question sentence is built by adding one of question particle to predicate (auxiliary verb or copula). We use ‘aux:q’ for all uses of the question particle. It also used in Hebrew, Turkish. (see Figure 4)

Figure 4: UD aux, compound and nmod analysis

• compound:redup
Reduplication is a common process especially for adverbs, adjectives, nouns in Uyghur. Reduplication typically involves two identical words, but some morpho-phonological alternations are possible. The forms of the reduplicate words in Uyghur are various, this subtype of compound covers a range of reduplicated forms in Uyghur. It is also used in Turkish as well. An example is given in Figure 4.

• dobj:cau & nmod:cau
We mark direct objects of causative verbs with ‘dobj:cau’, since the interpretation is different in comparison to a direct object of a non-causative verb. In general, if the verb is intransitive, direct object indicates the “causee”, the subject of the content verb, or the entity that performs the action. If the verb is transitive, the direct object is the entity that is acted upon as in the non-causative case use the subtype ‘nmod:cau’. They are also used in Turkish as well.

• nmod:tmod
Temporal modifiers specifying time, in nominal form, are labelled as ‘nmod:tmod’. English, Chinese, Danish, Russian etc. also uses this subtype label. See the Figure 4 for example.

• nmod:poss
This subtype is used in possessive constructions, typically, the head of the construction is a possessive noun phrase, and the dependent is in genitive case. Danish, English, French, German, Kazakh etc. also use the subtype. An example is giben in Figure 5.

• nmod:comp
This subtype of ‘nmod’ is used for marking comparative modifier of an adjective or adverb. The specific feature of it is a nominal word or phrase which attached ablative case suffix and an adjective or adverb. This subtype is also used in Turkish as well. See the Figure 5 for example.

• nmod:part
This subtype of nmod is used for marking the part-whole relations. This structure is similar to ‘nmod:poss’ in most cases, but the range structures expressing “part of” is diverse, and distinction is often be useful.

4 summary and future work
In this paper, we have summarized the conversion of the Uyghur Dependency Treebank (UyDT) to UD format. We have described in detail the mapping and conversion process, including structural
changes required, for the release of the UyDT as part of the Universal Dependencies project. We have also discussed linguistic analyses and motivations for choosing of Uyghur language-specific label types.

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