Albanian Part-of-Speech Tagging: Gold Standard and Evaluation

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Abstract
In this paper, we present a gold standard corpus for Albanian part-of-speech tagging and perform evaluation experiments with different statistical taggers. The corpus consists of more than 31,000 tokens and has been manually annotated with a medium-sized tagset that can adequately represent the syntagmatic aspects of the language. We provide mappings from the full tagset to both the original Google Universal Part-of-Speech Tags and the variant used in the Universal Dependencies project. We perform experiments with different taggers on the full tagset as well as on the coarser tagsets and achieve accuracies of up to 95.10%.

Keywords: Albanian, part-of-speech tagging, gold standard

1. Introduction
Albanian is an Indo-European language that is spoken by approximately 5.4 million people. Within the Indo-European family of languages, Albanian constitutes a subgroup of its own; it is a distinct branch on the same level as, for example, the Hellenic, Romance, Slavic or Germanic subgroups. The language has a diverse vocabulary with many loan words due to language contact with Greek, Latin/Italian, Slavic languages and Turkish.

Albanian has a rich morphological system and a relatively free word order, similar to, for example, German. Particularly challenging, from a pos tagging point of view, are the many multi-word units. An interesting and frequent phenomenon are multi-word units that have articles or particles as their first part. These combinations are borderline cases at the lexis-grammar interface. They are certainly more grammatical in nature and written as two separate graphical tokens. Here is one example from standard Albanian: i mirë “(the) good one” (masc.) vs. e mirë “(the) good one” (fem.). Presence or absence of the preceding article or particle can change the meaning of a word or its part of speech.

Albanian is one of the Balkan languages with the least resources available. In particular, there is no part-of-speech tagged corpus available, let alone one that covers the multi-word phenomena mentioned above. This paper is a step to improve that situation. In the next section, we briefly discuss previous work in the areas of part-of-speech tagging and morphological analysis. In Section 2.1, we present a new manually annotated gold standard corpus for part-of-speech tagging. The corpus is annotated with a medium-sized tagset that can adequately represent the multi-word phenomena mentioned above. To improve interoperability with existing multilingual tools and resources, we provide mappings to the popular Universal Part-of-Speech Tags, both the Google and the Universal Dependencies variant (Section 3). In Section 5, we perform evaluation experiments with different part-of-speech taggers on the full tagset and on the coarser UPOS tagsets.

2. Related Work

2.1. Part-of-Speech Tagging

Hasanaj (2012) presents two tagsets: A basic set that consists of 16 tags and a large set that consists of 326 tags. In the basic tagset, there are ten tags for the traditional parts of speech, three tags for delimiters, two for special cases (short forms of pronouns) and one for articles. The large tagset encodes the major word-classes and additional features like number or case. Hasanaj (2012) also attempts an evaluation of the two tagsets using a maximum entropy tagger and a perceptron tagger. However, his gold standard corpora consist only of 263 tokens for the basic tagset and 641 tokens for the large tagset.

Kadriu (2013) uses a tagset of 22 tags that refines the ten traditional parts of speech in some places and adds tags for feminine and masculine nouns, impersonal, reflexive, transitive and intransitive verbs, personal and possessive pronouns, determiners, exclamations, indeclinables and indefinite elements. Her tagging system is implemented on top of the NLTK unigram and regular expression taggers and uses a simple stemming algorithm to deal with unknown words. Her evaluation is based on 30 news articles from three domains. The number of tokens in the gold standard corpus is not mentioned in the paper.

The tagsets by Hasanaj (2012) and Kadriu (2013) are either very small or extremely large and do not cover the interactions between words and their preceding articles or particles described in Section 1. In our own previous work (Kabashi and Proisl, 2016), we introduce a medium-sized tagset for Albanian that consists of 67 tags and that aims to adequately represent the morphosyntactic properties of the Albanian language. In particular, combinations of preposed articles or particles with words of other word-classes are treated in a linguistically sensible way.
2.2. Morphological Analysis

There are a number of tools for the morphological analysis of Albanian that provide very detailed analyses but no disambiguation and no mapping to a medium-sized tagset. Trommer and Kallulli (2004) present a morphological analyzer that seems to cover the main inflection types of Albanian. Its output format follows the EAGLE guidelines standard (Leech and Wilson, 1999) in that the tags consist of sets of attribute-value pairs. The tags come in three varieties: Detailed, abbreviated and collapsed. We can gather from the paper that the tagset distinguishes between 17 broad word-class labels, seven of which are reserved for subtypes of pronouns, one for the preposed article, one for sentence equivalents, one for the particle form of the verb, and the rest for the traditional parts of speech. Trommer and Kallulli (2004) evaluate their morphological analyzer against a gold standard corpus consisting of 1,000 tokens.

The goal of the tool described in Piton et al. (2007) and Piton and Lagji (2008) is to cover the inflection of Albanian. For words forms that can have them, their analysis also allows for preposed articles. It is not clear how many morphological tags they have or on how many major word-classes the tagset is based, though it seems to cover at least the ten traditional parts of speech. Their papers do not include an evaluation. UniParser (Arkhangelskiy et al., 2012), the morphological analyzer used in the Albanian National Corpus, supports a variety of languages, e.g. Albanian, Greek, Kalmyk, Lengian and Ossetic. There seems to be no published information about the Albanian model.

The morphological analyzer and generator by Kabashi (2015) extends the traditional parts of speech with additional tags for things like abbreviations or punctuation marks. For some word-classes, e.g. pronouns, more fine-grained subtypes are specified and are given their own tags. The system can also handle the preposed articles or particles that can occur with some word-classes. The coverage of the morphological analyzer is evaluated against word lists that each comprise more than 100,000 entries.

3. Gold Standard

3.1. The Tagset

The tagset used to annotate the corpus is a revised version of our earlier draft (Kabashi and Proisl, 2016) that has been used in the corpus described by Kabashi (2017). Traditional grammars like Newmark et al. (1982), Buchholz and Fiedler (1987) or Demiraj et al. (1995) give ten parts of speech for Albanian: Nouns, verbs, adjectives, adverbs, pronouns, prepositions, conjunctions, numerals, particles and interjections. While we follow this general division, the tagset allows for more fine-grained distinctions within the traditional word-classes and has additional tags for things like interjections, articles, pronominal clitics, punctuation, etc. that do not fit into the traditional word-classes.

In the course of annotating the corpus, we came across phenomena that could not be adequately analyzed with the old version of the tagset. Therefore, we refined and extended it by introducing ten novel tags. We also renamed some of the existing tags to have a more consistent and transparent naming scheme. In particular, we make the following changes:

- We introduce four new verb tags: VImpv (imperative form of verb), VImpvCl (imperative with infixed clitic), VSubj (verb with subjunctive particle) and VSubjPass (verb with subjunctive and passive particles).
- We introduce three new tags for pronouns: PPersSF (short form of personal pronoun), PIndefA (indefinite pronoun preceded by article) and PIntC (interrogative pronoun C/τ).
- For multipart conjunctions, we distinguish between coordinating (ConjC1, ConjC2) and subordinating (ConjS1, ConjS2).
- We introduce two new particle tags: PtMod (modal particle), PtPass (passive particle) and PQual (question particle mos).
- Several tags were renamed to make them more consistent with the rest of the tagset. Now, all tags start with the major word-class (N, V, Adj, etc.) and are consistent with the rest of the tagset. Now, all tags start with the major word-class (N, V, Adj, etc.) and are consistent with the rest of the tagset.

The complete tagset is shown in Table 1.

3.2. The Corpus

We manually annotated a sample of 2,020 sentences (31,584 tokens) with the part-of-speech tagset described above. Half of the sentences have been randomly selected from a large collection of texts consisting of literary works, news and science articles and web texts. Selection of the other half has been guided by the wish to include as wide a variety of linguistic phenomena as possible in the gold standard corpus. Therefore, these sentences were manually selected and contain instances of rarer morphosyntactic phenomena. Consequently, the resulting corpus is definitely less homogeneous than a collection of whole documents and has a higher type/token-ratio.

The data was annotated by two native speakers who are trained linguists. For creating the gold standard, all controversial cases were discussed with a non-native speaker of the language who is a trained linguist. Table 2 gives agreement scores between the annotators and the gold standard. For this purpose, we also created two additional versions of the corpus where we mapped the manual annotations to two flavors of Universal Part-of-Speech Tags (cf. Section 4.).

The major differences between the annotators are visualized in Fig. 1. For this visualization, we map the tags to the coarser tagset used in the Universal Dependencies project (cf. the next section). As we can see, the two largest areas of disagreement between the annotators are within-class choices for pronouns and verbs. The annotators also disagree fairly often on whether a word is a particle, coordinating or subordinating conjunction. Fig. 2 gives a detailed visualization of the differences within the pronoun class. The major source of disagreement is the choice between PCI, i.e. pronominal clitics, and PCISubj, i.e. amalgamations of subjunctive particle and pronominal clitic. Fig. 3 visualizes the differences within the verbal class. Major sources of disagreement are the choices between V and VPass, V and VSubjCl, and VPass and VRelf.
Table 2: Agreement between annotators and gold standard

| # | Tag | Name | Example |
|---|-----|------|---------|
| 1 | N  | Noun | hënë |
| 2 | NA | Noun preceded by article | e hënë |
| 3 | NHg | Het. noun | art (sg. m.) vs. arte (pl. f.) |
| 4 | NE | Name | Pejë/Drinë/Joni |
| 5 | V  | Verb (finite forms) | tha |
| 6 | VPart | Participle (non-finite forms) | thënë |
| 7 | VCl | V. w. clitic | i tha |
| 8 | VImpv | Imperative form | Prit!/Fol! |
| 9 | VImpvCl | Imperative w. clitic | Tregonëni! |
| 10 | VPass | V. w. pass. part. | u tha |
| 11 | VPassCl | V. w. pass. and clitic | uu tha |
| 12 | VSubj | V. w. subj. particle | të thotë |
| 13 | VSubjCl | V. w. pass. and cl. | ta tha |
| 14 | VSubPass | V. w. subj. a. pass. part. | 'u thotë |
| 15 | VAux | Auxiliar verb | kam |
| 16 | VMod | Modal verb | mund |
| 17 | VRecp | Reciprocal verb | njihen |
| 18 | VRef | Reflexive verb | lahem |
| 19 | Adj | Adjective | djalë trim |
| 20 | AdjA | Adj. preceded by article | djalë i mirë |
| 21 | AdjP | Preposed adj. | trimi djale |
| 22 | AdjPA | Prep. adj. prec. by art. | i miri djalë |
| 23 | AdjN | Noninflected adjective | blëneto |
| 24 | Adv | Adverb | mirë |
| 25 | AdvPt | Adv. prec. by part. | së shpejti |
| 26 | AdvMP | Multpart adverb | kohë pas kohë |
| 27 | PPers | Personal pronoun | ti |
| 28 | PPersSF | Pers. pron. (short form) | talëlëto |
| 29 | PDem | Demonstrative pronoun | ky/këta |
| 30 | PDemA | PDem preceded by article | i tillë |
| 31 | PPoss | Possessive pronoun | im |
| 32 | PPossA | PPoss preceded by article | i tijë vetën |
| 33 | PInt | Interrogative | kush |
| 34 | PIntA | PInt preceded by article | i kujtli cilit |
| 35 | PIntC | Interrogative pronoun | Ç/C/ |
| 36 | PRel | Relative pronoun | që |
| 37 | PRelA | PRel preceded by article | i cili |
| 38 | Plndef | Indefinite pronoun | dikush |
| 39 | PlndefA | Plndef preceded by article | të tjerëve |
| 40 | PRefl | Reflexive pronoun | me vete |
| 41 | Prep | Preposition | mëpal nga për |
| 42 | ConjC | Coordinating conjunction | dhe |
| 43 | ConjS | Subordinating conjunction | që |
| 44 | ConjC1 | First part of coord. conj. | edhe ... dhe |
| 45 | ConjC2 | Second part of coord. conj. | edhe ... edhe |
| 46 | ConjS1 | First part of subord. conj. | le që ... por |
| 47 | ConjS2 | Second part of subord. conj. | le që ... por |
| 48 | NumC | Cardinal number | dy fitore |
| 49 | NumO | Ordinal number | fitorja e dytë |
| 50 | Pt | Particle | ja |
| 51 | PtComp | Comparative particle | më i mirë |
| 52 | PtCond | Conditional particle nël po | nëlpo ... |
| 53 | PtFut | Future particle | do |
| 54 | PtGer | Gerundive particle duke | duke ecur |
| 55 | PlInf | Infinitive particle për | për |
| 56 | PtJus | Jussive particle le | le |
| 57 | PtMod | Modal particle | mund |
| 58 | PtNeg | Negation particle | naktëm shju |
| 59 | PtNegD | Negation particle dot | s'irak dot |
| 60 | PtNegS | Negation particle s' | s' punon |
| 61 | PtPass | Passive particle u | u |
| 62 | PtPassCl | Pass. part. with clitic | iu |
| 63 | PtPriv | Private particle pa | pa punuar |
| 64 | PtProg | Progressive particle po | po lexon |
| 65 | PtProh | Prohibitive particle | mos |
| 66 | PtQA | Question particle Ala | A punon? |
| 67 | PtQM | Question particle mos | Mos iku? |
| 68 | PtSubj | Subjunctive particle të | të |
| 69 | Intj | Interjection | olm/iuhlii |
| 70 | Art | Article | ile/lëlsë |
| 71 | PCI | Pronominal clitic | i |
| 72 | PCI2 | 2nd part of pron. clitic | e [in: na e] |
| 73 | PCSI | Subj. particle and PCI | ta [i. c. të-e] |
| 74 | Abbr | Abbreviation | d.m.th./letj. |
| 75 | FW | Foreign word/Non-Alban. | web |
| 76 | Punct | Punctuation (sent.-ending) | . . ! |
| 77 | Punct2 | Punctuation (not sent.-end.) | . : -- |
| 78 | NLE | Non-linguistic element | . § % ... |
| 79 | EM | Emoticon | ;-) |

Table 1: Tagset.

Table 2: Agreement between annotators and gold standard for the full tagset and for versions mapped to the coarser tagsets. Values are accuracy percentages.

| # | Tag | Name | Example |
|---|-----|------|---------|
| 1 | Prep | Preposition | mëpal nga për |
| 2 | ConjC | Coordinating conjunction | dhe |
| 3 | ConjS | Subordinating conjunction | që |
| 4 | ConjC1 | First part of coord. conj. | edhe ... dhe |
| 5 | ConjC2 | Second part of coord. conj. | edhe ... edhe |
| 6 | ConjS1 | First part of subord. conj. | le që ... por |
| 7 | ConjS2 | Second part of subord. conj. | le që ... por |
| 8 | NumC | Cardinal number | dy fitore |
| 9 | NumO | Ordinal number | fitorja e dytë |

4. Mapping to Universal Part-of-Speech Tags

For some applications and use-cases, it is useful to have a more coarse-grained set of part-of-speech tags that makes a broad distinction between word-classes but abstracts away from most of the additional properties encoded in the tagset described above. Rather than invent a new coarse-grained set of labels, we adopt the popular Universal Part-of-Speech Tags that have become a quasi standard. There are two flavors of Universal Part-of-Speech Tags:

- Google UPOS, the original Google Universal Part-of-Speech Tagset by Petrov et al. (2012) that consists of 12 tags and

https://github.com/slavpetrov/universal-pos-tags
5. Evaluation

For our evaluation, we perform tagging experiments using the following part-of-speech taggers:

- UD UPOS, the refined version used in the treebanks of the Universal Dependencies project (Nivre et al., 2016) that consists of 17 tags.

In Table 3 we provide a mapping from our tagset to both varieties of the Universal Part-of-Speech Tagset. The mapping is straightforward. All of our tags can be seen as refinements of the Universal Part-of-Speech Tagset – a deliberate design choice.

The results are shown in Table 4. At first glance, they seem to be rather modest. Using the full tagset, the best tagger achieves 91.00% accuracy – a good six points less than the state of the art for languages like English, French or German. However, we have to take into consideration that our corpus is orders of magnitude smaller than for example the Wall Street Journal part of the Penn Treebank and that it is at the

http://universaldependencies.org/

https://code.google.com/archive/p/hunpos/

https://opennlp.apache.org/

http://www.cis.uni-muenchen.de/~schmid/tools/TreeTagger/

https://github.com/tsproisl/SoMeWeTa

https://nlp.stanford.edu/software/tagger.html

Figure 1: Tagging differences between the annotators. For clarity of presentation, we map the tags to UD UPOS tags, i.e. entries on the diagonal indicate differences between tags that get mapped to the same UD UPOS tag.

Figure 2: Tagging differences between the annotators (pronominal tags only).

Figure 3: Tagging differences between the annotators (verbal tags only).
Training the taggers using the full tagset and mapping the predicted tags to one of the UPOS tagsets eliminates within-class errors produced by the taggers and leads to much better results with up to 94.68% accuracy. For almost all taggers, this setting works better than training directly on one of the coarser tagsets, i.e. the taggers benefit from a more fine-grained internal representation. The exception to this rule is SoMeWeTa, the only tagger provided with additional external knowledge in the form of Brown clusters, which achieves better results of up to 95.10% when trained directly on the coarser tagsets.

The main sources of errors for SoMeWeTa on the full tagset are visualized in Figure 4. The largest group of errors is confusion between different verb tags. Next are confusions between different noun tags (mostly between N and NHg) and, to a lesser extent between verb and noun tags and between different tags for pronouns. The most frequent misclassifications for the 20 tags with the most errors are shown in Table 5. The single most difficult distinction for the tagger is that between N and NHg, i.e. between nouns and heterogeneous nouns. This is not surprising given that this is a lexical distinction that cannot be deduced from context. To be able to correctly distinguish between the two, the tagger must have seen the word during training or must be provided with a corresponding lexicon. Other frequent misclassifications include noun (N) vs. proper noun (NE), noun (N) vs. adjective (ADJ) and coordinating conjunction (ConjC) vs. article (Art).

6. Conclusion and Future Work

Up to now, there has been no manually tagged corpus of substantial size for Albanian. The gold standard presented in this paper is by far the largest manually tagged corpus for Albanian and consists of 2,020 sentences (31,584 tokens) annotated with a medium-sized part-of-speech tagset designed with a focus on the syntagmatic aspects of the language, especially multi-word units involving articles or particles. While the corpus is still too small to achieve state-of-the-art tagging accuracies comparable with those for better-resourced languages, the evaluation experiments show very promising results similar to what could be expected from an English corpus of similar size. For the coarser tagsets, we achieve accuracies of up to 95.10%. We are also optimistic that the results could be further improved by providing the taggers with an additional lexicon. Such a lexicon could be derived from one of the existing morphological analyzers.

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Table 5: The 20 tags that SoMeWeTa most frequently misclassified.

| tag   | freq | err | most frequent confusions |
|-------|------|-----|--------------------------|
| N     | 5470 | 233 | NE (63), NHg (45), Adj (35), V (25) |
| Adv   | 965  | 198 | N (67), ConjS (21), Prep (20), Pt (20) |
| V     | 1562 | 178 | N (62), VRefl (32), VCl (22), VSubj (18) |
| ConjC | 1234 | 172 | Art (98), ConjS (19), Pt (16), PCI (10) |
| NHg   | 493  | 155 | N (141), NE (3), VRefl (3), Adj (2) |
| VRefl | 401  | 150 | V (56), VPass (35), VSubj (19), N (11) |
| ConjS | 656  | 133 | PRel (56), ConjC (20), Adv (18), N (10) |
| Pt    | 292  | 131 | Adv (25), ConjC (20), ConjS (15) |
| Adj   | 904  | 112 | N (69), NE (10), V (8), AdjA (8) |
| VCl   | 486  | 82  | V (14), N (13), AdjA (13), VRel (11) |
| VPass | 142  | 82  | VRefl (57), V (14), VPart (3), PtPass (2) |
| VSubj | 376  | 70  | VPart (15), AdjA (14), VSubjCl (9) |
| PIndef| 308  | 69  | Adv (20), N (19), PIndefA (8), Plnt (4) |
| PCI   | 694  | 68  | Art (29), PtPass (14), PtSub (9) |
| NE    | 712  | 63  | N (54), Adj (3), AdjA (3), PCI (1) |
| Prep  | 2292 | 63  | Adv (14), Plntf (10), PtComp (10), V (5) |
| NA    | 124  | 57  | AdjA (28), N (16), PlntfA (5), VCl (2) |
| AdjA  | 1118 | 54  | N (17), NA (7), VCl (6), NE (5) |
| VPart | 526  | 52  | N (20), AdjA (8), VSubjCl (8), VCI (3) |
| Art   | 2996 | 46  | PtSubj (16), PCI (11), ConjC (11) |

Table 4: Evaluation results (mean accuracy percentages ± 2 standard deviations).

| tagger           | full tagset | UD UPOS | Google UPOS | mapped to UD UPOS | mapped to Google UPOS |
|------------------|-------------|---------|-------------|-------------------|-----------------------|
| HunPos           | 88.73 ± 0.79 | 92.44 ± 1.18 | 93.63 ± 1.18 | 92.72 ± 0.86 | 94.04 ± 0.78 |
| SoMeWeTa         | 91.00 ± 0.83 | **94.32** ± 1.40 | **95.10** ± 1.38 | **93.99** ± 0.97 | **94.68** ± 0.97 |
| TreeTagger       | 88.14 ± 1.12 | 91.15 ± 1.69 | 92.15 ± 1.87 | 92.24 ± 1.20 | 93.43 ± 1.17 |
| OpenNLP          | 87.50 ± 1.23 | 89.87 ± 1.39 | 91.24 ± 1.35 | 90.64 ± 1.35 | 91.98 ± 1.20 |
| Stanford Tagger  | 85.96 ± 1.26 | 89.72 ± 1.28 | 91.37 ± 1.24 | 89.92 ± 1.39 | 91.36 ± 1.49 |

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