

SUPPLEMENT

Translate and Label! An Encoder-Decoder Approach for Cross-lingual Semantic Role Labeling

A.1 Model and Training Details

All versions were trained up to 30 epochs using Adam optimizer with a learning rate of $1e-4$. We use early stopping (with patience of 5 epochs) based on the BLEU score of the Development Set. We represent both words and labels as tokens using N-dimensional vectors. We use pre-trained word embeddings for the 3 languages that we fine-tune during training. The dimension of embeddings change depending on the pre-trained representations used for each kind of model: 300 for GloVe, 768 for BERT and 1024 for ELMo. All models use the same Encoder (8-layer interlaced BiLSTM 4 forward and 4 reversed layers) of 300-dimensional hidden size and a single-layer decoder with hidden size of 500. Our predicate feature embedding and language embedding are 100 and 200 dimensions respectively. Given memory constraints, the batch size is smaller (12 instead of 32) for the models that use contextual representations.

Parameter	Size
Encoder Embedding Size [GloVe, BERT, ELMo]	[300, 768, 1024]
Vocabulary Size	Freq > 5
Encoder Layers	8
Decoder Layers	1
Encoder Hidden	300
Decoder Hidden	300
Attention	1024
Language Embedding Size	200
Predicate Indicator	100
Epochs	30
Early Stopping Patience	5 epochs
Optimizer	Adam
Learning Rate	0.0001
Batch Size [GloVe, Other]	[32, 12]
Gradient Clipping	5
Dropout	0.1

A.2 Annotation Guidelines

A.2.1 Overall Sentence Annotation

Quality Mark on a scale from 1-5 how grammatical the sentence is:

1 = This sentence is completely ungrammatical.

5 = This sentence is perfectly grammatical.

Naturalness Mark on a scale from 1-5 how natural the sentence is:

1 = A native speaker would never produce such a sentence.

5 = This sentence could have been written by a native speaker.

- Mark the sentence as #NO-VERB if the marked predicate is NOT a verb.

A.2.2 Predicate-Argument Annotation

For each sentence:

1. The predicate of interest is given.
2. Argument Identification:
 - (a) You should generate as many questions as possible using this predicate. The answers must be a sub-string [phrase] from the sentence.
 - (b) Write a single Question-Answer pair per line.
 - (c) Once you cannot think of more Q-A pairs for this sentence, you should fill the column named "head" with the syntactic head of each answer phrase you entered in step 2c.
3. Argument Classification (Labeling):
 - (a) Assign the closest possible labels to each Q-A pair according to the criteria of the Annotation Process

A.2.3 Labeling Criteria

Kinds of Roles

1. **Core Roles (A0-A4):** are supposed to be agents and patients of the sentence, and to be closely related to the action that the verb describes.
2. You can find the list of roles of interest in the Auxiliary Table at the end of this document.
3. **Modifier Roles (AM-XXX):** are general and not tied to specific predicates. Example: (# because AM-CAU) will always be causal regardless of the predicate. Locations will always be places regardless of the action happening, and so on.

Annotation Process

1. Start by confirming that the given predicate is a Verb. If this is the case, write in the question field the token #VERB, the answer should be the predicate itself and the label should be marked as V.
2. As a General Rule, assign labels in this order: A0 >> A1 >> A2 ... texttt; AM-XX
3. Always start asking *Who?/ What?* (A0). This label should always be assigned first (if it exists in the sentence). A0 is always the causation of a change of state (normally is an agent but in some exceptions, it could be the patient. Either way, it should be the main cause of the change of state that the verb represents).
4. Ask again the question *What?*. Now the label for this answer will be A1. A1 is normally the patient of that change of state. There are exceptions (normally with passive sentences) where you would have A1 without A0 in a sentence. Example: The (# book A1) was given (# to A2) him. Here the sentence does not contain an answer to the question *Who gave the book?* therefore it has no A0 role. However, the first question you will ask is *What was given?* and the answer *The book* should be labeled as A1 (skipping A0) because it is the patient of the 'to give action. There are also cases where there are secondary animated participants in the patient role, for example, *John has been fooled by Mary: What?* Does not refer to John, but you need *Whom?*, and then John will be labeled as A1.
5. If there is no answer to *What?* in the sentence, and/or there are still questions to ask which have a patient as an answer, (someone or something affected by the action that is not only a general modifier of the situation), then use A2 - A4. The indices of core roles are assigned incrementally (for example, there can't be an A3 if there is no A2). In the example shown in 4, the prepositional phrase to him is the answer to the question *To whom was the book given?*, therefore to is labeled with A2 because it is the second patient found in the sentence (and it is the head of the answer phrase).
6. Next, try to ask the questions *Where? Why? How?...* whose answers will be modifier AM-XXX roles.
7. Finally, consider that there some are roles that do not answer questions:
 - (a) AM-NEG: this is used for the negations in the sentence. Write in the question field the token #AM-NEG, in the answer field the phrase that expresses negation, and the label should be marked as AM-NEG. Example: (# You A0) will (# never AM-NEG) know.

- (b) AM-DIS: this is used for the discourse markers in the sentence. Write in the question field the token #AM-DIS, in the answer field you should put the phrase that is acting as a discourse marker, and the label should be marked as AM-DIS. Also, you should apply this label for vocatives (For example, Dear (# Mr. AM-DIS) President, ...). In this case, write in the question field the token #VOCATIVE.
- (c) AM-MOD: this is used for the modal verbs in the sentence (when they are not the predicate of interest). For example, I (# must AM-MOD) give this (# book A1) (#to A2) her. Write in the question field the token AM-MOD, and in the answer field the answer should be the modal verb and the label will be marked as AM-MOD.

Examples

(# I A0) tried to give (# her A2) (# a book A1), (# but she doesn't like to read AM-DIS).

In this case, A0 is the giver (*Who?*), A1 is the thing given (*What?*) and A2 is the recipient (*To whom?*), and receives A2 because it is a secondary agent that is related to the act of giving. This tagging is following the rule of first asking who, then what, and then assigning core roles incrementally if there are more found.

A.2.4 Useful Remarks

Examples of most common heads

1. In the case of a Prepositional Phrase, the argument head is the preposition. E.g. (# In AM-LOC) diesem Bereich. Normally, this preposition (together with the rest of the phrase) would be the direct answer to the WH-Word used for the question.
2. For a Noun Phrase, the noun is the head der Europäischen (# Kommission A1).
3. For verbs with a separable prefix, the head must be the main part (the stem). Example: Ich (# rufe V) Sie an .

Notes

1. After asking the common questions (*Who? What? To Whom?*) for agents and participants, try to find questions whose answers are Prepositional Phrases.
2. Try to state as many questions as possible, but always include the predicate in the question.

3. Always include in the answers all the relevant participants related to the given predicate.

WH-Phrase Correlation Table

Role	Question
A0 [Agent]	Who? What?
A1 [Patient]	What? Who? How much?
A2 [Patient 2]	What? How much? Where?
A3 [Patient 3]	What? Who?
A4 [Patient 4]	-
AM-DIR [Direction]	To where?
AM-LOC [Location]	Where?
AM-MNR [Manner - modify verb]	How?
AM-TMP [Temporal]	When?
AM-EXT [Extent]	How much? How?
AM-PNC [Purpose]	Why?
AM-CAU [Cause]	Why?
AM-ADV [Adverbial - modify entire sentence]	Why?
AM-DIS [Discourse Marker / Vocatives]	#AM-DIS / #VOCATIVE
AM-MOD [Modals]	#AM-MOD
AM-NEG [Negation]	#AM-NEG

A.3 Statistics on Manually Annotated Data

ANNOTATED ROLE	COUNT
A0	198
A1	195
A2	45
A3	1
A4	2
AM-ADV	22
AM-CAU	16
AM-DIR	1
AM-DIS	63
AM-LOC	12
AM-MNR	29
AM-MOD	86
AM-NEG	22
AM-PNC	8
AM-TMP	34