Preposition error correction using Tree Convolutional Networks

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Problem

Preposition error correction ⊂ Grammar error correction

The semester starts on January. We reached at the airport on time.

The semester starts in January. We reached the airport on time.

(Replacement) (Deletion)

This is a comfortable house to live.

This is a comfortable house to live in.

(Insertion)
Problem

Preposition error correction ⊆ Grammar error correction

The semester starts on January. We reached at the airport at 9 pm.
The semester starts in January. We reached the airport at 9 pm.

(Replacement) - This project (Deletion)

This is a comfortable house to live.
This is a comfortable house to live in.
Approaches

- Classification - Articles, Prepositions, Noun number
- Machine Translation - Broad class of errors
Approaches

- Classification - Articles, Prepositions, Noun number
- Machine Translation - Broad class of errors

In this project: Preposition classification
Idea

Use context (rest of sentence) to predict preposition

Dependency parse tree provides natural structure
I asked the professor for an extension
Idea

Perform convolutions on parse tree

Learn features (word -> phrase embeddings)

Classify using features of neighbours
Idea

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Idea

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Network Architecture

Pretrained word embeddings (GloVe)
Experiment details

Training and eval data

- BAWE corpus
- Collection of assignment texts from universities, English discipline assignments
- 22,000 + 2,500 train-dev split

Test data

- CoNLL-14 shared task test data
- 2650 correct examples, 107 erroneous examples
Experiment details

Frameworks used

- SyntaxNet (Dependency parsing and POS tags)
- Tensorflow (for training)
Results

Baseline (parent child word embeddings, fully connected layers):
- Evaluation accuracy: 65.78%
- Test accuracy: 50.20%

Experiment (tree convolution):
- Evaluation accuracy: 66.56%
- Test accuracy: 54.15%
Plots

Training and eval accuracy vs # training steps (Experiment)
Plots

Training and eval accuracy vs # training steps (Baseline)
Future work

- Try higher dimension embeddings with more training data
- Look at other ways to learn phrase embeddings
- Identify which examples are “hard” (need more context than just parent and child)
References

https://arxiv.org/abs/1609.02907
http://www.aclweb.org/anthology/N16-1042
https://dl.acm.org/citation.cfm?id=2002589