Conversions for heterogeneous treebank parsing (2)

L715: Seminar on: Data manipulation for parser improvement

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Emphasizing the need for features

Zhu et al. (2011)

Source bracketing can be used as parsing constraints during decoding of a target parser

- But consider figure 1 in Zhu et al. (2011)
  - Tsinghua Chinese Treebank (TCT) tree: verb “deems” is at the right bracket of a phrase
  - Penn Chinese Treebank (CTB) tree: verb “deems” is at the left boundary of a phrase
- These annotations are *inconsistent*
  - A source parsing constraint may thus prune such a constituent

Alternative: use source bracketing structures as **guiding information**

Generic System Architecture

1. Build *source parser* & parse target treebank
2. Build a parser on (parsed-source, gold-target) sentence pairs
   - **heterogeneous parser**: incorporates information from both styles
3. Testing: take gold source parses as input and converts them

Feature-based parsing algorithms are used, to incorporate source bracketing structures

Shift-Reduce-Based Heterogeneous Parser

Shift-reduce parser uses transitions between states $< S, Q >$ (S=stack of partial parses, Q=queue of word-POS pairs)

- Heterogeneous parsing works similarly to standard way
  - Tree transformed to binary tree
  - Binary tree decomposed into gold action-state sequences
  - Train classifier on states, which are represented as feature vectors
- Feature set is augmented with features bridging current state and source parse

Features

- Target-side features: same as earlier parser
- Heterogeneous features:
  - Constituent features (e.g., bracketing matches?)
  - Relation features (e.g., nodes are identical or sisters?)
  - Frontier features (e.g., words in same base phrase?)
  - Path features (e.g., syntactic path?)

Look at table 1 to unpack these a bit ...

Experiments

Table 2 reports conversion accuracy

- All heterogeneous features improve conversion accuracy
- Impact of path feature is small, possibly due to sparseness

nb: this was done on top of POS conversion (96.2% accuracy)

Projected Treebank as Source Corpus

Jiang and Liu (2009)

Problem: Projected treebanks inherit the standard of the source

- Adapt the divergence automatically
- Boost parsing performance with additional parsed trees

Error-Tolerant Tree Projection

Many approaches directly map from source to target

- Their method works by looking for the best consistency with source trees:

$$(1)\quad \hat{T}_C = \arg\max_{T_C} C(T_C|T_E, A)$$

- Measures the degree to which Chinese tree (T_C) is consistent with English tree (T_E)
- They accumulate scores across all possible alignments, making it more error-tolerant

More details in the paper

Annotation Adaptation

Train *source parser* & parse target corpus

- Then, a *target parser* is trained
  - crucially, with guide features extracted from source parser's output

When testing, data is first parsed by source parser as an intermediate parsing result

- Then, the target parser with guide features is used
- Automatically learns the regularities of the intermediate parse

Guide Features

They work with MSTParser, tailoring guide features to it

- i.e., define features on dependency edges (cf. edge-factorization)
- Examine relationship between head and modifier in source parse:
  - Feature: Does the relationship exist? (cf. stacking)
  - Features: combinations of lexical features of MST models
- Define relationships as a variable covering these cases:
  - parent-child, child-parent, siblings, else

Experiments

Project English trees to Chinese & select those between 6 & 100 words and with a high enough projection confidence

- Source = PTB, Target = Penn Chinese Treebank (CTB)
- Source parser: 1st-order MST, Target parser: 2nd-order MST

Source parsers perform poorly (around 53%), while target parser is around 83-87% & higher than baseline

References

Jiang, Wenbin and Qun Liu (2009). Automatic Adaptation of Annotation Standards for Dependency Parsing — Using Projected Treebank as Source Corpus. In *Proceedings of the 11th International Conference on Parsing Technologies (IWPT'09)*. Paris, France: Association for Computational Linguistics, pp. 25–28.

Zhu, Muhua, Jingbo Zhu and Minghan Hu (2011). Better Automatic Treebank Conversion Using A Feature-Based Approach. In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies*. Portland, Oregon, USA: Association for Computational Linguistics, pp. 715–719.