Learning to Differentiate Better from Worse Translations

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1. Task Formulation

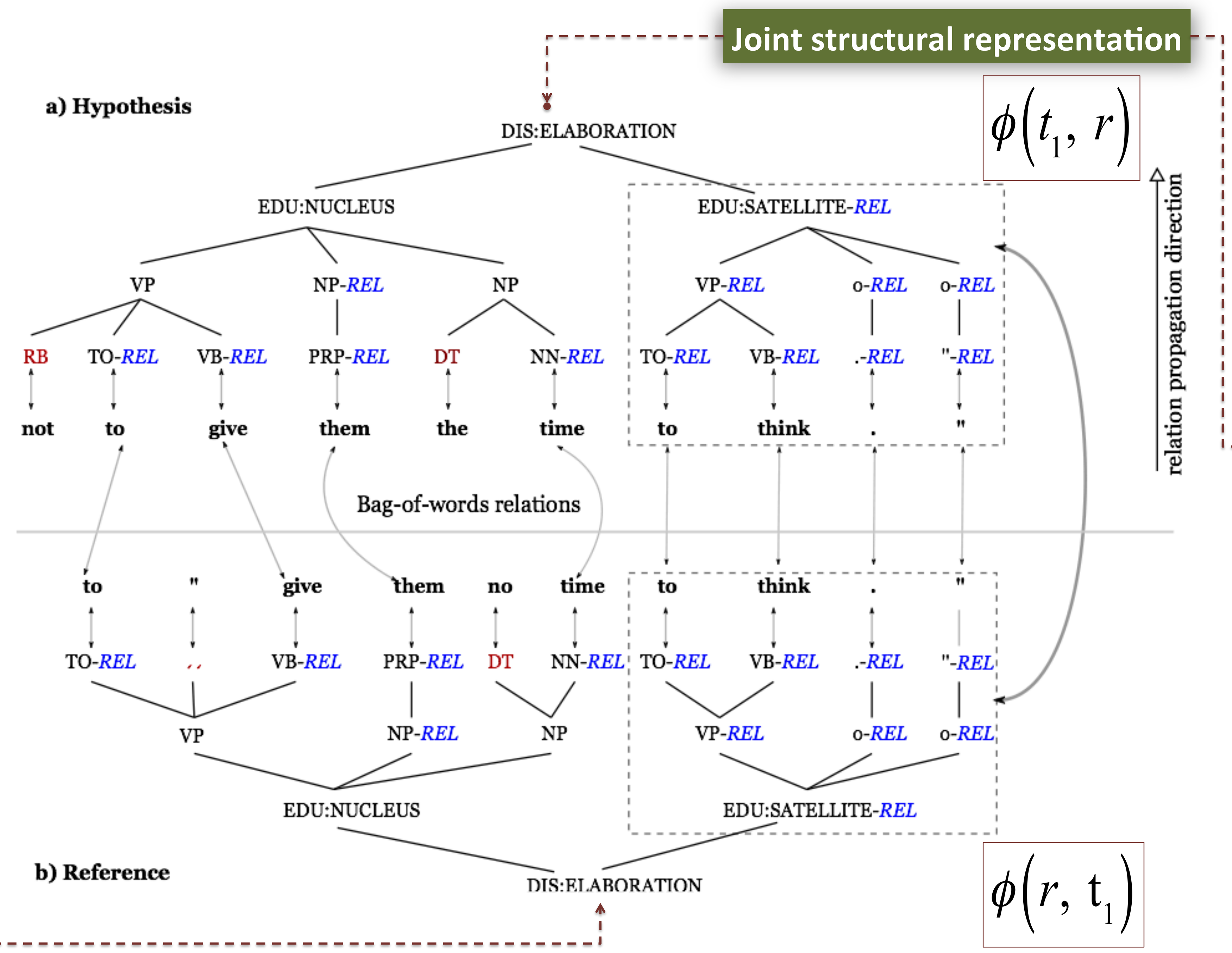
- Decide which of two alternative translations t_1 and t_2 is better given the reference r
- **Motivation**: Higher correlation with human judgments compared to absolute scores (Duh,2008; Song&Cohn,2011)

2. Proposed Solution

- Use the framework of **structured kernel learning** (Severyn&Moschitti, 2012)
  - Pairwise learning to rank formulation with kernels
  - Is more powerful than kernel similarity (Guzmán et al., 2014)
  - Learns features (structure fragments) automatically
  - Allows integrating several information sources

  Highlights!
- Integrate *lexical, syntactic,* and *discourse information* in a single *structural representation*
- Use both reference and system output simultaneously
  - **Learning object:** $\langle t_1, t_2, r \rangle$

3. Enriched Structural Representation



4. Structured Kernel Learning

Preference Kernel

$$PK(\langle t_1, t_2, r \rangle \langle t_1', t_2', r' \rangle) = K(t_1, t_1' | r, r') + K(t_2, t_2' | r, r') + K(t_1, t_2' | r, r') + K(t_2, t_1' | r, r')$$

Kernel

Where $K(t_1, t_1' | r, r') = PTK(\phi(t_1, r), \phi(t_1', r')) + PTK(\phi(r, t_1), \phi(r', t_1'))$

Partial Tree Kernel

5. Experimental Settings

- **Train**: 10K judgments per language (WMT-11)
- **Langs**: Czech–English (cs-en), German-English (de-en), Spanish-English (es-en), French-English (fr-en)
- **Eval**: Kendall's Tau as a measure of correlation on WMT-12 data (official)
- **Results are compared with direct kernel similarity**

6. Evaluation Results

Train & Test for each language pair separately on different structures

		Similarity					Structured Kernel Learning				
	Structure	*cs*-en	*de*-en	*es*-en	*fr*-en	all	*cs*-en	*de*-en	*es*-en	*fr*-en	all
1	SYN	0.169	0.188	0.203	0.222	0.195	0.190	0.244	0.198	0.158	0.198
2	DIS	0.130	0.174	0.188	0.169	0.165	0.176	0.235	0.166	0.160	0.184
3	DIS+POS	0.135	0.186	0.190	0.178	0.172	0.167	0.232	0.202	0.133	0.183
4	DIS+SYN	0.156	0.205	0.206	0.203	0.192	**0.210**	**0.251**	**0.240**	**0.223**	**0.231**

SYN (syntactic parse), DIS (RST discourse parse relations), POS (part of speech)

Observations

- **Learning with structural kernels works better than using simple kernel similarity ⇒ new features are learned**
- Shallow syntax and discourse yield similar improvement individually
- Combining them yields further improvement
- **We outperform popular metrics like TER (0.217), NIST (0.214) and BLEU (0.185)**

Cross-language training and testing

		Testing				
	Train	*cs*-en	*de*-en	*es*-en	*fr*-en	all
1	*cs*-en	0.210	0.204	0.217	0.204	0.209
2	*de*-en	0.196	0.251	0.203	0.202	0.213
3	*es*-en	0.218	0.204	**0.240**	0.223	0.221
4	*fr*-en	0.203	0.218	0.224	0.223	0.217
5	all	**0.231**	**0.258**	0.226	**0.232**	**0.237**

Observations

- Same language training is better in most cases
- However, overall differences are rather small
- Training on all language pairs yields the best results in all cases except for es-en

7. Conclusion

- Unified framework for integrating layers of linguistic information for MT evaluation
- Pairwise learning-to-rank with structural kernels
- Competitive performance

8. Future Work

- More linguistic information: SRL, Brown clusters, etc.
- Integrate scores from other MT evaluation metrics
- Use of more relations between *t* and *r*.

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