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Rule-based Coreference Resolution in German Historic Novels

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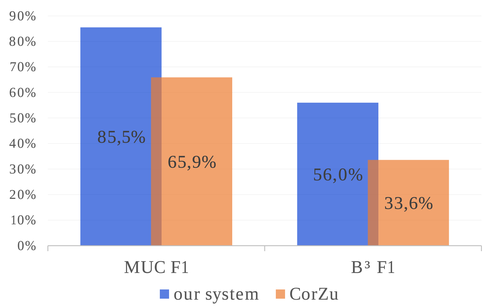
Data and Methods

- standard Coreference Resolution systems have been developed on newspaper texts
- moderate performance on German novels because of domain differences
    - more pronouns
    - more direct speech
    - few large clusters with long coreference chains
- rule-based system with 11 passes ordered by decreasing precision, similar to [Lee et al. 2005]
    - explanation component facilitates error analysis and rule refinement
    - no large annotated novel training corpus available
- manually annotated corpus sampled from about 80 novels for development and evaluation

Results

- better results than state-of-the-art system CorZu [Klenner 2011]
- pronoun resolution (pass 9) brings by far the most improvement
- 86.0% MUC-F1 and 55.5% B^3-F1 on completely unseen data



Scores in %	Our system evaluated with the novel corpus	
Passes	MUC-F1	B^3-F1
1	27.5	24.6
1-4	37.7	28.1
1-8	38.9	28.9
1-9	83.3	52.6
1-11	85.5	56.0

Coreference Resolution in 11 Passes

1. **exact match**
   All identical non-pronouns are marked as coreferent, also if their cases differ
2. **nameflexion**
   Distance metric to detect derivatives of names or nicknames (“Lydia”, “Lyden”, “Lydchen”)
3. **attributes**
   Modifiers are matched against NEs of other clusters (“die alte Gertrud”, “die Alte”)
4. **precise constructs**
   Appositions, relative and reflexive pronouns are assigned to the preceding NE. Subsequently, the pronouns get the number and gender of the matched NE.
5. **strict head match**
   Two NEs consisting of more than one word are marked as coreferent if at least one word occurs in both strings and they agree in gender and number.
6. **relaxed head match**
   One word of one NE is contained in a word of the other NE and they agree in gender and number.
7. **title match**
   Titles are matched to the most recent NE containing the given title. This title match pass is necessary as titles are disregarded in passes 5 and 6.
8. **semantic pass**
   Match synonyms using GermaNet if they agree in gender (“Gatte”, “Gemahl”)
9. **pronoun resolution**
   Pronouns are resolved to the most recent, suitable preceding NE
10. **addressee detection in direct speech**
    For each direct speech, the addressed person is identified using lexico-syntactic patterns
11. **pronouns in direct speech**
    Resolve all instances of "I“ to the speaker and all instances of “you“ to the addressee

Error Analysis

Explanation and annotation editor

- on-click display of key attributes for each NE token
- highlighting of direct speech and speaker
- possible classification of coreference errors according to their type

Categories of errors

- 14% of total errors due to wrong assignment of gender, number or person and direct speech respectively, to be improved with more precise grammatical constraints

Document (novel fragment)	# NEs	# Cluster (Gold)	# Cluster found	MUC F1	B^3 F1	# Errors	# Wrong gi|n|p	# Ds related	# Heuristics	# Semantic
1	332	16	64	86%	46%	58	3	22	21	12
2	185	8	22	94%	80%	16	1	4	3	8
3	261	31	44	90%	80%	22	6	0	6	10
4	283	28	47	77%	38%	48	5	2	20	21
5	469	39	39	90%	66%	61	13	1	22	25
Sum						205	28	29	72	76
Average	306	24	43	87%	62%	100%	14%	14%	35%	37%

References

Lee, H., Peirsman, Y., Chang, A., Chambers, N., Surdeanu, M. and Jurafsky, D. 2011. *Stanford's multi-pass sieve coreference resolution system at the CoNLL-2011 shared task.* Proc. Of the 15th Conference on Computational Natural Language Learning: Shared Task (CONLL shared Task ‘11). Association for Computational Linguistics, 28-34.

Klenner, M., Tuggener, D. 2011. *An incremental entity-mention model for coreference resolution with restrictive antecedent accessibility*. Recent Advances in natural Language Processing (RANLP 2011), Hissar, Bulgaria, 178-185.

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