

EGK Seminar 13.06.2002 Olga Ourioupina

Overview

- Main Subtasks
- Existing Algorithms

pronominal anaphor definite descriptions – coreference definite descriptions – bridging

My Proposal, Plans, ...

aquiring knowledge using knowledge



Main Subtasks

- Identifying discourse-new entities
- Finding possible antecedent(s)
- Identifying the Relation Type

Pronominal anaphor

Baseline algorithms:

- take the previous NP
- take the previous subject NP

Accuracy - 60-70%

1

Pronominal anaphor

Traditional approaches

- RAP (Lappin & Leass, 1994) syntax-based
- Centering (Grosz, Sidner, 1986) focus tracking
- Mitkov 1994, 1996 syntax-based, incl. semantic/domain modules

Accuracy

RAP - 86%

LRC - 80%

Mitkov – 87%

Pronominal anaphor

Alternative approaches

Dagan & Itai, 1990 – corpus-based	87%
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- Kennedy & Boguraev, 1996 RAP-based, no parsing 75%
- Mitkov, 1996 no parsing
 90%
- Baldwin, 1997 (COGNIAC) no parsing R=64%, P=92%



Definite NPs (Coreference)

Baseline algorithms

- All NPs are coreferential
- All NPs with at least one common word are coreferential
- All NPs with the same head noun are coreferential

Accuracy on MUC-6 data (Soon et al., 2001)

	R	Р	F
ALL	89.9	31.8	47.0
ONE_WRD	55.4	36.6	44.1
HD_WRD	56.4	50.4	53.2



Definite NPs (coreference)

Models based on Commonsense Reasoning

- Extensive use of hand-coded commonsense knowledge
- Evaluation impossible

Sidner, 1972

Carter, 1987

Alshawi, 1992 (Core Language Engine)

Gardent & Konrad, 1999



Definite NPs (Coreference)

Real applications MUC-6 (1995)

```
R P F
best 59% 72% 65%
worst 36% 44% 40%
```

MUC-7 (1998)

	R	Р	F
best	56.6%	84.3%	67.7%
worst	52.5%	21.4%	30.4%



Definite NPs (Coreference)

Vieira, Poesio, Teufel,.. – knowledgebased approach

- WordNet
- Various heuristics
- (Corpora)

Accuracy (F):

Identifying first-mentioned entities 70%

Same-head NPs71-77%

Bridging (incl. Synonyms)33%

-

Definite NPs (Coreference)

Other approaches

Cardie & Wagstaff, 1999 – Coreference as Clustering

Distance Metric based on Feature Vectors

Features: Distance, Animacy,..., Semantic Class (WordNet)

Accuracy on MUC-6 data: R=53%, P=55%, F=54%

 Hartrumpf, 2001 – Combining Syntactico-Semantic rules and Corpus Statistics (German)

ENTITY and SORT features from MultiNet

Accuracy: R=55%, P=82%, F=66%



Definite NPs (bridging)

Asher & Lascarides

Theoretical analysis

Vieira, Poesio, Teufel

Implemented system, however, the performance is low.



Gardent&Konrad – Using Model Generation for Definite NPs Resolution

- Huge hand-coded KB required
- Semantic representation of the whole sentence required
- Salience and precedence information not included
- Extremely slow for more than 4-5 entities



What kind of knowledge do we need?

- (Almost) all the coreference resolution systems make use of WordNet, GermaNet,...
- Soon et al., 2001: 75% mistakes due to the lack of semantic knowledge (63.3% – not enough features, 11.7% – errors in class determination).
- Not too sophisticated knowledge (sortal information, for example).



Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

- Discourse new
- Anaphoric (same head)
- Syn/Hyp/Mer
- Names
- Compounds
- Events
- Discourse Topic
- Inference

The National Assembly, for the past year,..



Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

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President Roh Tae Woo's administration

The administration



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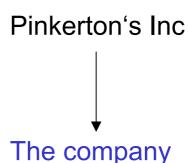
President Roh Tae Woo's administration

The government



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Individual investors and professional money managers contend.

They make the argument ...



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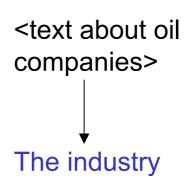
Stock market crash

The markets



Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

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Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

- Discourse new
- Anaphoric (same head)
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- Names
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- Events
- Discourse Topic
- Inference

Last week's earthquake

The suffering people



Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

Discourse new

47%

Anaphoric (same head) 30%

Syn/Hyp/Mer

Names

Compounds

20%

Events

Discourse Topic

Inference



Classification of Definite Descriptions based on the information required for their processing (Poesio & Vieira)

Discourse new

Anaphoric	(same head)	19%

• Syn/Hyp/Mer

Names

Compounds 12%

Events

Discourse Topic7%

■ Inference 18%

WordNet (Miller, 1993)

```
Hyponyms: wordnet, sense 1
```

- => lexical database
 - => electronic database, on-line database,...
 - => database
 - => information, info
 - => message, content,...
 - => communication
 - => social relation
 - =>relation
 - =>abstraction

Information in WordNet

- Sorts (for coreference) hypo/hyper
- Synonyms
- Meronyms/holonyms (for bridging)

Poesio, Vieira & Teufel, 1997 – Resolving Bridging References in Unrestricted Text

WordNet Precision – max 28%

Recall – max 46%

Problems with WordNet

- Not all the words are covered (Proper Names!)
- Disambiguation problems
- Hierarchy problems
 - 1. jackfruit, jak, jack (immense East Indian fruit resembling breadfruit of ..)
 - 2. jack (an electrical device consisting of a connector socket ..)
 - 3. jack (game equipment ..)
 - 4. jack (small flag indicating a ship's nationality)
 - 5. jack, knave (one of four face cards in a deck bearing a picture of a young prince)
 - 6. jack (tool for exerting pressure or lifting)
 - 7. jack (any of several fast-swimming predacious fishes ..)
 - 8. jack, jackass (male donkey)

Problems with WordNet

- Not all the words are covered (Proper Names!)
- Disambiguation problems
- Hierarchy problems

Holonyms: tree_branch
Sense 1
limb, tree branch
PART OF: tree

Problems with WordNet

- Not all the words are covered (Proper Names!)
- Disambiguation problems
- Hierarchy problems
 - 1. (58) cut (separate with or as if with an instrument; "Cut the rope")
 - 4. (2) cut (make an incision or separation; "cut along the dotted line")
 - 29. cut (reap or harvest; "cut grain")
 - 30. cut (fell by sawing; "The Vietnamese cut a lot of timber..")
 - 33. cut (shorten as if by severing the edges or ends of; "cut my hair")
 - 41. cut (...)

Problems with WordNet

- Not all the words are covered (Proper Names!)
- Disambiguation problems
- Hierarchy problems

```
Overview: branch
```

- 1. (19) branch, subdivision, arm (an administrative division ..)
- 2. (15) branch (a division of a stem .. of a plant)
- 3. (5) branch, fork, leg (a part of a forked or branching shape)
- 6. (..)

Holonyms: branch

Sense 3

branch, fork, leg

PART OF: furcation, bifurcation, forking

Problems with WordNet

- Not all the words are covered (Proper Names!)
- Disambiguation problems
- Hierarchy problems

Hyponyms: geological_phenomenon geological_phenomenon

- ⇒ earthquake, quake, temblor, seism
- ⇒ alluvial fan, alluvial cone
- ⇒ catastrophe, cataclysm
- ⇒ continental drift
- ⇒ deposit, sedimentation, alluviation
- ⇒ flood, inundation, deluge, alluvion
- ⇒ frost heave, frost heaving
- ⇒ volcanism

Knowledge Sources – Corpora

Selectional constraints and preferences

This book is about the Syberian Tri-colored Rabbit. They eat carrots.

```
They=?
```

⇒ books

⇒ book+rabbit

⇒ .

Knowledge Sources – Corpora

Selectional constraints and preferences

This book is about the Syberian Tri-colored Rabbit. They are carnivorous.

```
They=?
```

- ⇒ books
- ⇒ book+rabbit
- ⇒ .



Knowledge Sources – Corpora

Smoothing

- context-based
- class-based (WordNet!)
- alternative



Knowledge Sources – Internet

Overcoming data sparseness problem

- Unseen word combinations
- Proper Names classification

Problems with Internet

- Noisy unbalanced data
- No possibility of sophisticated search/analysis
- Slow

Using knowledge

Acquired facts may be unreliable, contradicting, ...

I entered the room. $\frac{10^3*(f(a,b))^2}{f(a)*f(b)}$

The ceiling was high. 10

The size was overhelming. 4.2

The windows looked out to the bay. 3.7

The chandelier sparkled brightly. 0.45



Possible solutions

- Probabilistic reasoning
- Nonmonotonic reasoning

Conclusion

Good and reliable Semantic Knowledge is crucial for coreference resolution systems. Possible knowledge sources:

- WordNet
- Corpora
- Internet
- (Hand-coded) Knowledge Base

Current work

- Using Internet for Proper names classification (Geography)
- Baseline algorithm for coreference resolution