Using Explicit Semantic Models to Track Situations across News Articles

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Using Online News to Track Situations

- Read an article about an event
  - What happened before?
  - What might happen next?
  - Who are the people involved in this?
- Interested in many situations evolving over time
  - Want alerts when something new happens
- Explore use of structured representation

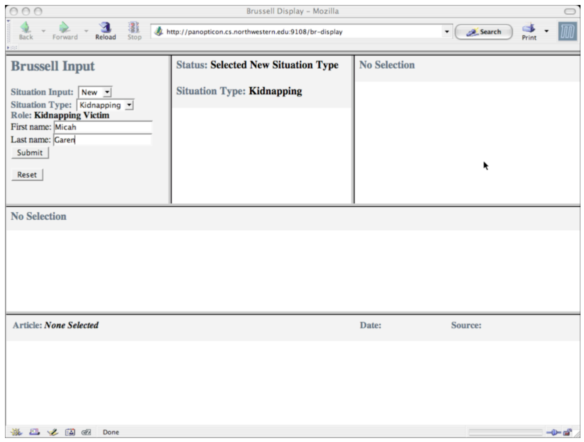
Technical Challenges

- Scale: Perform better with more data
- Aggregate information from multiple accounts
  - Complementary, redundant, or contradictory
  - Reduce noise due to inaccurate extraction
- Integrate IR, IE, & semantics
  - Use semantic models as structured contexts to drive IR & IE
  - Contexts provide structure for aggregation

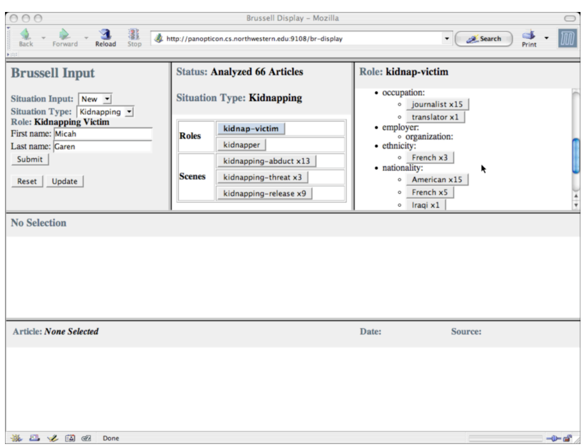
Brussell Overview

- Generates structured summary of situation
  - Extracts info about events and entities
  - Links to textual sources of extracted information
  - User can track over time with STT/Brussell + Cyc
- Represents situations as scripts
  - Events are scenes, entities are roles / actors
- Uses scripts to retrieve/extract info and organize for presentation to user
- Currently supports terrorism script types:
  - kidnappings, sieges

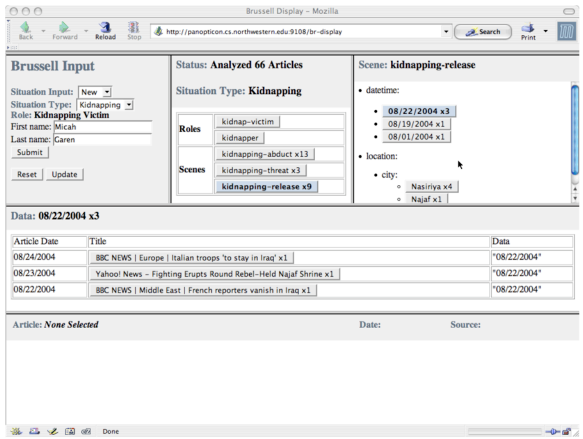
Brussell Demo I



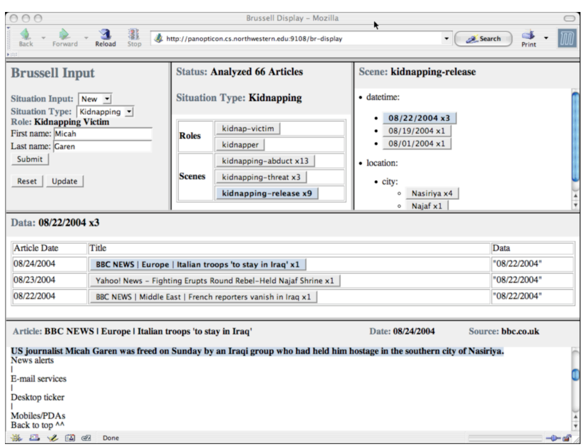
Brussell Demo II



Brussell Demo III



Brussell Demo IV



Implementation: Database

- Retrieves news articles from database
- ~400,000 articles in a MySQL database
  - Acquired from April 2004 to present
  - About 500/day retrieved via RSS feeds
  - Sources: NYTimes, Washington Post, Yahoo! News (AP, Reuters, UPI), etc.
  - Standard MySQL text indexing and querying

Implementation: Retrieval

- Perform query combining script type keywords and user supplied parameters, e.g.,
  - "+<name> +(kidnap* abduct* capt* seiz*)"
  - Here, kidnap victim's name is "seed" with specificity
- For each article that comes back
  - Split article into text fragments, for now sentences
- For each fragment with seed
  - Look for scene terms in fragment

Implementation: Extraction

- Fastus-style Cascaded Finite State Transducer
  - But top-down rather than bottom-up
  - Don’t extract something unless you know what you’re going to do with it
- Each level above triggers patterns below
  - Abduction scene: “X ‘kidnapped’ Y.”
  - Search for descriptions of kidnapper in region X and kidnap victim in region Y
- Generate scene instance and incorporate into current script

Implementation: Aggregation and Voting

- Aggregate references within script’s hierarchy and count as votes, e.g.
  - # of times scene referenced -> votes for its occurrence
  - # of times person name appears with nationality X vs. nationality Y
- Semantic model structures and constrains aggregation
  - Scene choice

What's New?

- Like Message Understanding Conference (MUC) systems, read article, fill out templates with event info
  - But, templates are part of larger structures
    - Share parameters
    - Represent relations
- Like old-style NL systems
  - But deeper understanding than from one article
  - How to aggregate info from the 100 or 10000 results from Google News?

Evaluation

- AP list of 36 kidnappings of foreigners in Iraq in October 2004
- Hand assembled reference data of 34 kidnapping script instances
- For each script instance, compute precision and recall based on
  - Scene choice
  - Scene data
    - Date and time, and location
  - Role data
    - Biographical
- At the time of evaluation, the corpus contained approximately 250,000 articles retrieved from April 2004 to February 2006

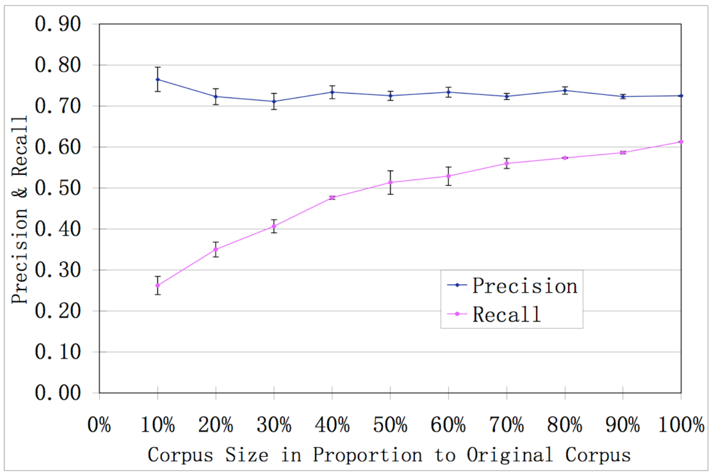
Brussell's Performance

- Precision:
  - Mean 73%
  - Standard Deviation 19%
- Recall:
  - Mean 59%
  - Standard Deviation 20%
- Performance comparable to MUC-7 systems
  - Simple extraction techniques + voting + hierarchical models

Relationship between Performance and Corpus Size

- Evaluation was done on subsets of the corpus of different sizes
- Expectation: With larger corpus, both precision and recall on slots would increase using voting

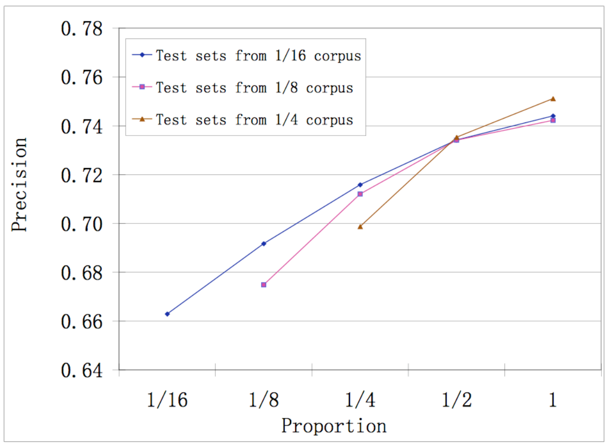
Relationship between Performance and Corpus Size I



What's Wrong?

- This analysis aggregates over all extracted slots
  - Previously filled slots and newly filled slots are lumped together
- Maybe improvement in previously filled slots is obscured by errors in newly filled slots

Relationship between Performance and Corpus Size II



Improving Syntactic Competence

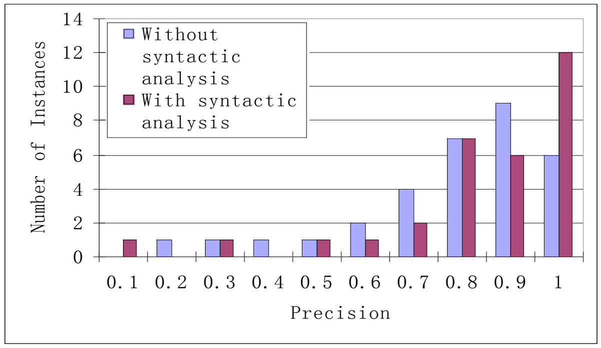
- False positive due to complex grammatical structure
- Syntactic preprocessing: simplifying the sentence syntactically

- *"A South Korean hostage threatened with execution in Iraq has been killed, officials in Seoul have confirmed,"*

  ==>
- *"A South Korean hostage has been killed."*

(S (NP (NP A South Korean hostage)
(VP threatened
(PP with (NP execution))
(PP in (NP Iraq))))
(VP has VP been (VP killed)))) ,
(NP (NP officials) (PP in (NP Seoul)))
(VP have (VP confirmed .)))

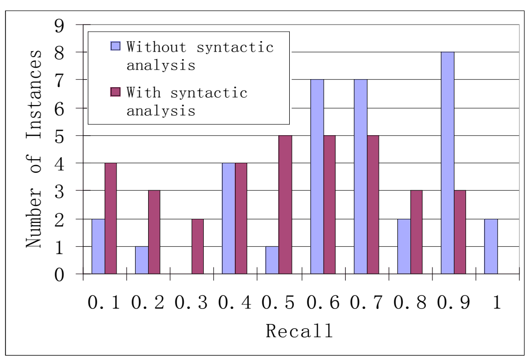
Overall Precision



Distribution of Overall Precision of 34 Test Cases

	Average	Standard Deviation:
Without SA:	73%	19%
With SA:	81%	23%

Overall Recall



Distribution of Overall Recall of 34 Test Cases

	Average	Standard Deviation:
Without SA:	59%	20%
With SA:	44%	22%

Digging Deeper: Performance on Specific Cases

- Good
  - Big: Margaret Hassan
  - Small: Micah Garen
- Bad: Eugene Armstrong
  - Problems
    - Info for group members conflated
    - Name Eugene is also treated as location
  - These highlight need for semantic constraints applied at multiple levels

Future

- GATE for IE, Lucene for IR
- Smarter voting - not just at leaves
  - Kidnapper: “John or Abu”, “Smith or Zarqawi”
  - Scene occurs in a single location at a single date and time - otherwise create multiple scenes
- Rely on user to merge/split problem cases
- Deeper integration of IR and IE
  - Crystallize around certainty
  - Perform queries to fill in unfilled/uncertain slots

Summary

- Semantic models provide
  - Driver for IR, IE
  - Structure for aggregating then voting
  - Organization for presentation to user