Enriching Narrative Event Chains

Nate Chambers, Dan Jurafsky
Stanford University

NSF Semantic Symposium (Nov 2008)

Scripts

- Background knowledge for language understanding

Restaurant Script

- Very specific
- Hand-coded
- Domain dependent
- Non-existent in open domain text?
Mitnick grew up a shy loner who found delight and a sense of power through his computer. "He is an overweight computer nerd, but when he is behind a keyboard he feels omnipotent," said Harriet Rossetto, a counselor at the Beit T'Shuvah treatment center in Los Angeles, where Mitnick was treated in 1989, under the order of a federal judge, for his "addictive" attraction to computer hacking.

Always fascinated by spying, he fancied himself a master at foiling and eluding the authorities, much like a role model, the character played by Robert Redford in "Three Days of the Condor." In the 1975 movie, Redford portrays a CIA employee who used his knowledge of the telephone network to avoid capture by sinister forces in the government.

Mitnick developed his passion for computing at Monroe High School in the Los Angeles suburb of Sepulveda, where he was raised by his mother, Shelly Jaffee, a waitress who had divorced Mitnick's father when their son was 3. Mitnick got in trouble at his high school for tapping into the Los Angeles School District's computer. He began spending time with a loosely knit group of "phone phreaks," young people whose hobby was illegally mastering the inner workings of the telephone switching system.

His first brush with the law came in 1981, when, as a 17-year-old, he was arrested for stealing computer manuals from Pacific Bell's switching center in Los Angeles. He was prosecuted as a juvenile and sentenced to probation. A year later, he was caught breaking into computers at the University of Southern California and was jailed for six months.

The exploits of Mitnick, who worked at various computer programming jobs to support himself, became legendary. For example, after he gained control of the telephone switching network in Los Angeles, he reprogrammed the system to mislead federal agents trying to trace his call. Thinking they had found his hideout, they barged into the home of a Middle Eastern immigrant watching television.

After being denied a job in computer security by the Security Pacific Bank, he created a fake news release stating inaccurately that the bank would show a loss of $400 million for the quarter and tried to distribute it on a business news service. (The news service detected the ruse in time to stop it.) In 1987, he was arrested for electronically breaking into a computer at the Santa Cruz Operation, a software publisher. He pleaded guilty to a misdemeanor, paid a small fine and was placed on three years' probation.

A year later he was arrested again, this time by FBI agents, for stealing prototype operating-system software from the Digital Equipment Corp. He was later convicted. The FBI had closed in on him only after he tried to harass a friend and partner in crime by pretending to be an IRS agent and making threatening calls to his friend's employer. His friend then told the authorities what Mitnick had done.

A man with a passion for gathering dossiers and playing tricks on both friends and enemies, Mitnick so intimidated the authorities when he was arrested in 1988 that Judge Marian R. Pfaelzer of the Federal District Court in Los Angeles initially ruled that he could not have access to a telephone for fear of the damage he might cause.
With Arguments

Police, Agent, Authorities
- elude
- arrest
- surrender
- Prosecutors, Attorney
- prosecute
- testify
- sue
- Plea, Guilty, Innocent
- convict
- sentence
- Judge, Official
- jail

The Protagonist

protagonist:
(noun)
1. the principal character in a drama or other literary work
2. a leading actor, character, or participant in a literary work or real event
Narrative Event Chain

- **Narrative Event Chain**: a partially ordered set of narrative events that share a common actor (the protagonist)

- **Narrative Event**: a tuple of an event and its participants, represented as typed dependencies

- **Before Relation**: \( B(e_i, e_j) \) is true if \( e_i \) occurs strictly before \( e_j \) in time

---

Inducing a Narrative Chain

1. **Narrative Relation Induction**
   - based on shared arguments
   - information-theoretic similarity scores
Inducing a Narrative Chain

1. Narrative Relation Induction
2. Temporal Ordering of Events

Inducing a Chain

1. Narrative Relation Induction
2. Temporal Ordering of Events
3. Structured Selection (pruning and clustering)
1. Inducing Narrative Relations

1. **Narrative Coherence Assumption**: verbs sharing coreferring arguments are semantically connected by virtue of narrative discourse structure.

2. Corpus counts of pairs of events sharing arguments.
   * Pointwise mutual information to measure strength of relations

3. The protagonist-based approach captures grammatical constraints.
   * push = fall
   * push X = X fall
**Narrative Prediction Example**

- (Unordered) Narrative Chain

  
  \[
  \text{score}(e, N) = \sum_{g \in N} \text{pairscore}(g, e)
  \]

  1. sentenced P: 1.600  
  2. charged P: 1.545  
  3. jailed P: 1.521  
  4. tried P: 1.513  
  5. booked P: 1.495

- Rank predictions with cluster scores

**II. Temporal Ordering**

1. Form profit expectations  
2. Increased competition occurs  
3. Price-cutting occurs  
4. Make a profit  
5. Record the profit results  
6. Report profit results  
7. Cite price-cutting as a problem

Smallish reported that earnings declined in the income for the third quarter, citing price-cutting by competitors. Arnold's results were somewhat worse than expected. Jay Stevens said he expected Arnold to earn 50 cents a share for the quarter and said the firm's weaker profit was partly the result of increased competition from IBM.
Prosecution Chain

Some transitive relations have been removed from the diagram.

Enriching the Chains

Constraints on the protagonist
- definition of narrative chains
- ACL-08

1. Constrain all entities
   - Further inform inference

2. Identify entity types
   - Selectional preferences
   - Slot fillers (frames)
Applications

- Selectional Preferences
  - Use chains to inform argument types
- Coreference
  - Argument prediction
- Summarization
  - Inform sentence selection with event confidence scores
- Textual Inference
  - Does a document infer other events
- Aberration Detection
  - Detect surprise/unexpected events in text

Around the Lab

1. Acquiring lexical and ontological knowledge

2. Measuring the growth and spread of ideas using topic models

3. Narrative Event Chains