Computational Lexical Semantics

Lecture 9: Learning Narrative Frames

Linguistic Institute 2005
University of Chicago

Unsupervised Semantic Role Labeling

- Could we learn frames from text?

  Inducing Semantic Roles:

  Swier and Stevenson (2004), He and Gildea, 2006, Grenegar and Manning 2006, Titov and Klementiev (2012), Lang and Lapata (2014)

- We'll see how to learn something similar:
  - Narrative frames
  - The work of Nate Chambers:

Something in the air around 1975 about "background knowledge"

Framing (Goffman 1974)

Frames (Minsky 1974)

Interactional frames (Hymes 1974)

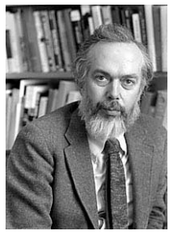
Schemata (Norman 1975)

Scripts (Shank and Abelson 1975)

Frames (Fillmore 1976)

With influences dating back to Bartlett 1932 and Bateson 1955…

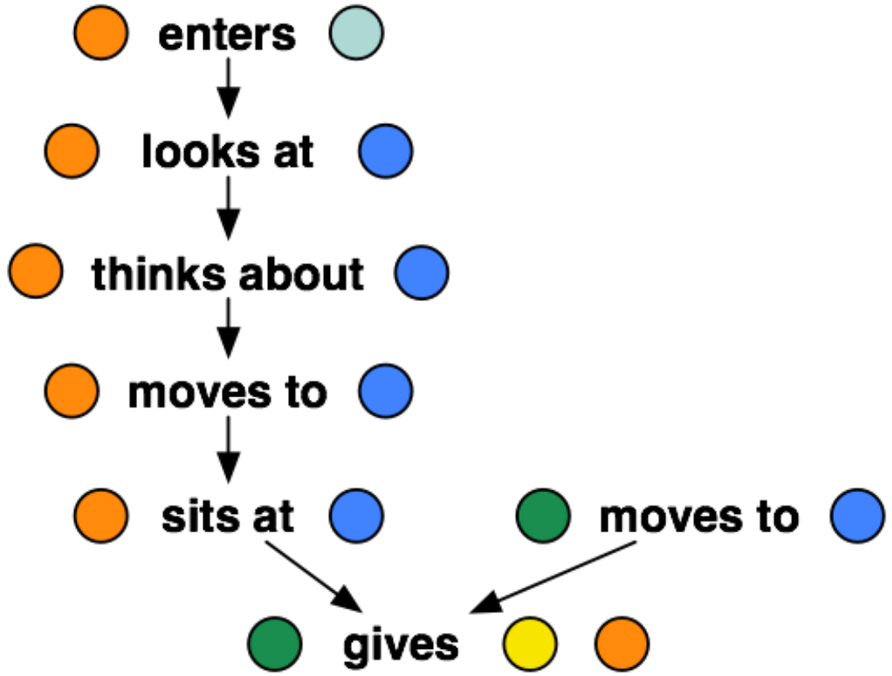
Scripts



Schank and Abelson. 1977. *Scripts Plans Goals and Understanding*. Lawrence Erlbaum.

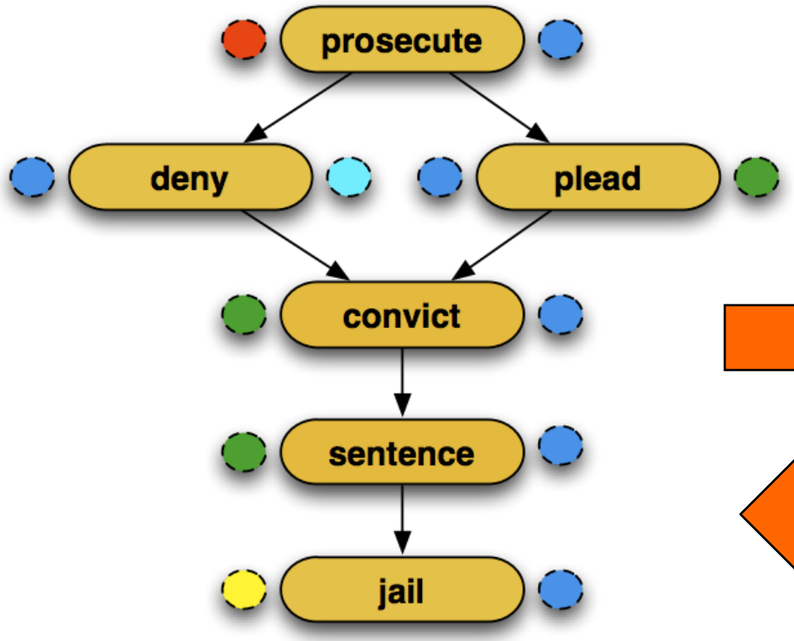
Background models, like frames, focused on sequences of events and participants

Restaurant Script



Learning Scripts/Frames: Nate's Two Joint Tasks

1. Events in the Narrative | 2. Semantic Roles of the Participants



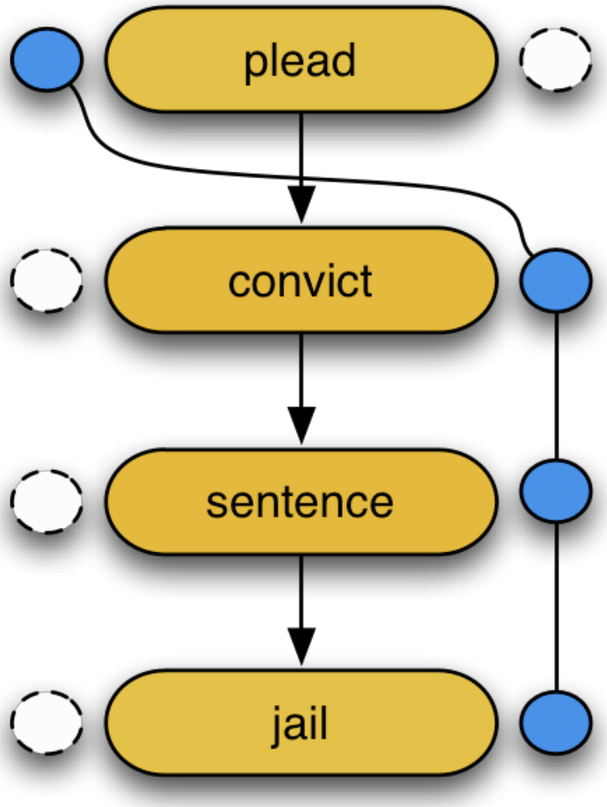
- suspect, criminal, client, immigrant, journalist, government, …
- police, agent, officer, authorities, troops, official, investigator, …

1. Learning Narrative Event Chains

Chambers and Jurafsky. *Unsupervised Learning of Narrative Event Chains*. ACL-08

Narrative Event Chain:

a partially ordered set of narrative events that share a common actor (the protagonist)



Intuition for learning meaning from text

Narrative Coherence Assumption

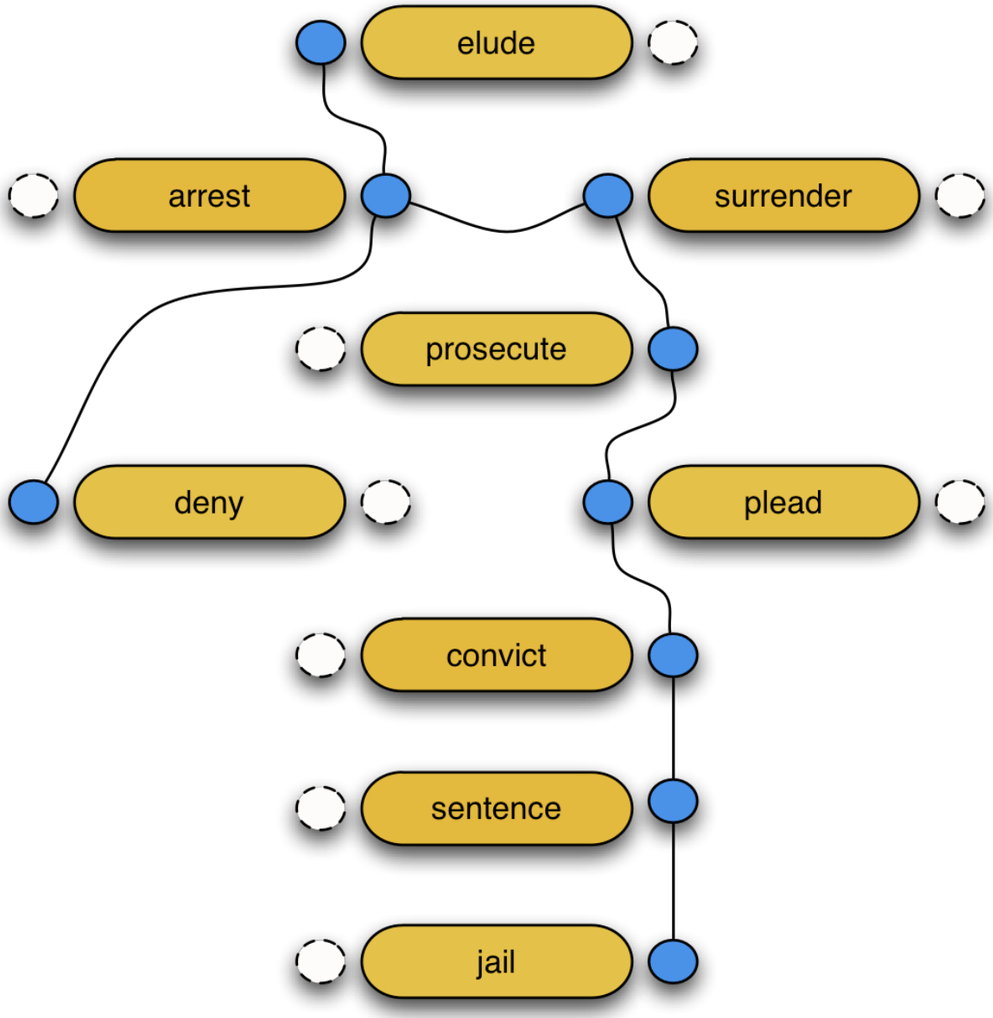
Narratives are about protagonists.
Events with shared arguments are connected.

Centering (Grosz, Joshi, Weinstein 1983)
Cohesion (Halliday and Hasan 1976)

…blizzard dumped **snow**…
…They've been shoveling **it**…

Dumping **is-related-to** shoveling

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

Processing a sample text

The oil stopped gushing from BP's ruptured well in the Gulf of Mexico when it was capped on July 15 and engineers have since been working to permanently plug it. The damaged Macondo well has spewed about 4.9m barrels of oil into the gulf after an explosion on April 20 aboard the Deepwater Horizon rig which killed 11 people. BP said on Monday that its costs for stopping and cleaning up the spill had risen to $6.1bn.

Sample text: find events

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Sample text: find arguments

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Sample text: coreference

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The oil stopped

gushing from **BP's ruptured well**

it capped

engineers working

engineers plug

plug **it**

The damaged Macondo well spewed

spewed **4.9m barrels of oil**

spewed into **the gulf**

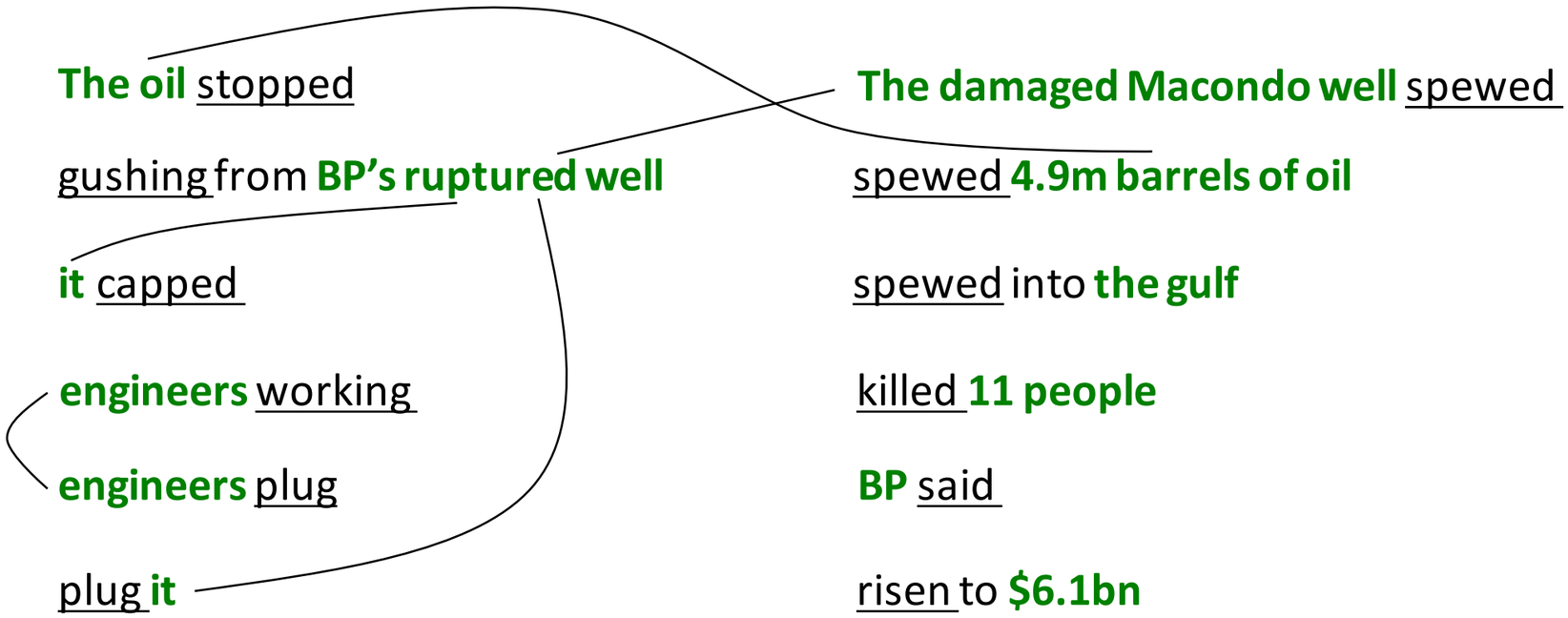
killed **11 people**

BP said

risen to **$6.1bn**

Sample text: coreference

The oil stopped gushing from **BP's ruptured well** in the Gulf of Mexico when **it** was capped on July 15 and **engineers** have since been working to permanently plug **it**. **The damaged Macondo well** has spewed about **4.9m barrels of oil** into the **gulf** after an explosion on April 20 aboard the Deepwater Horizon rig which killed **11 people**. **BP** said on Monday that its costs for stopping and cleaning up the spill had risen to **$6.1bn**.



Sample text: group events

The oil stopped gushing from **BP's ruptured well** in the Gulf of Mexico when **it** was capped on July 15 and **engineers** have since been working to permanently plug **it**. **The damaged Macondo well** has spewed about **4.9m barrels of oil** into the **gulf** after an explosion on April 20 aboard the Deepwater Horizon rig which killed **11 people**. **BP** said on Monday that its costs for stopping and cleaning up the spill had risen to **$6.1bn**.

gushing from **BP's ruptured well**

it capped

The damaged Macondo well spewed

plug **it**

The oil stopped

spewed **4.9m barrels of oil**

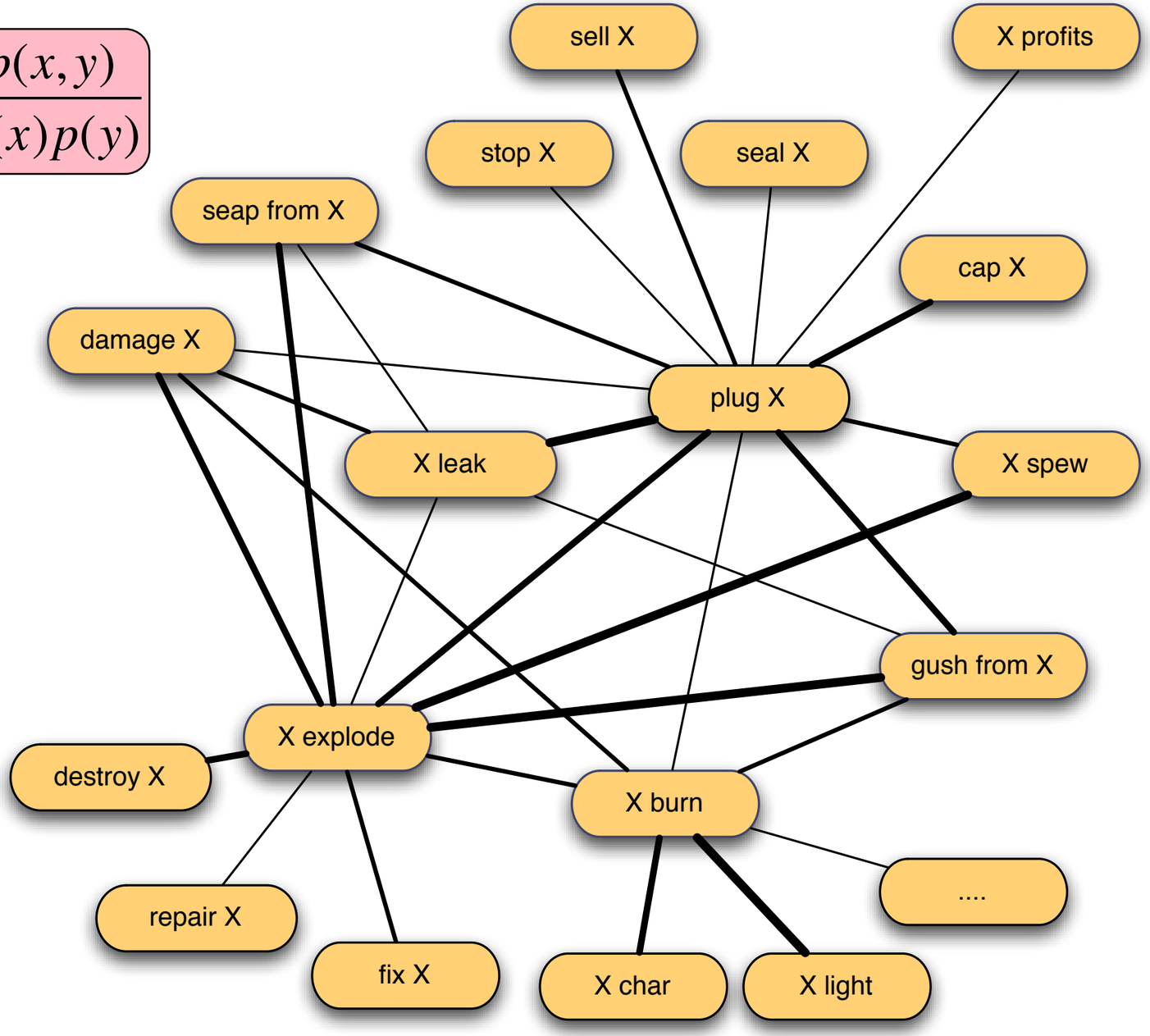
engineers working

engineers plug

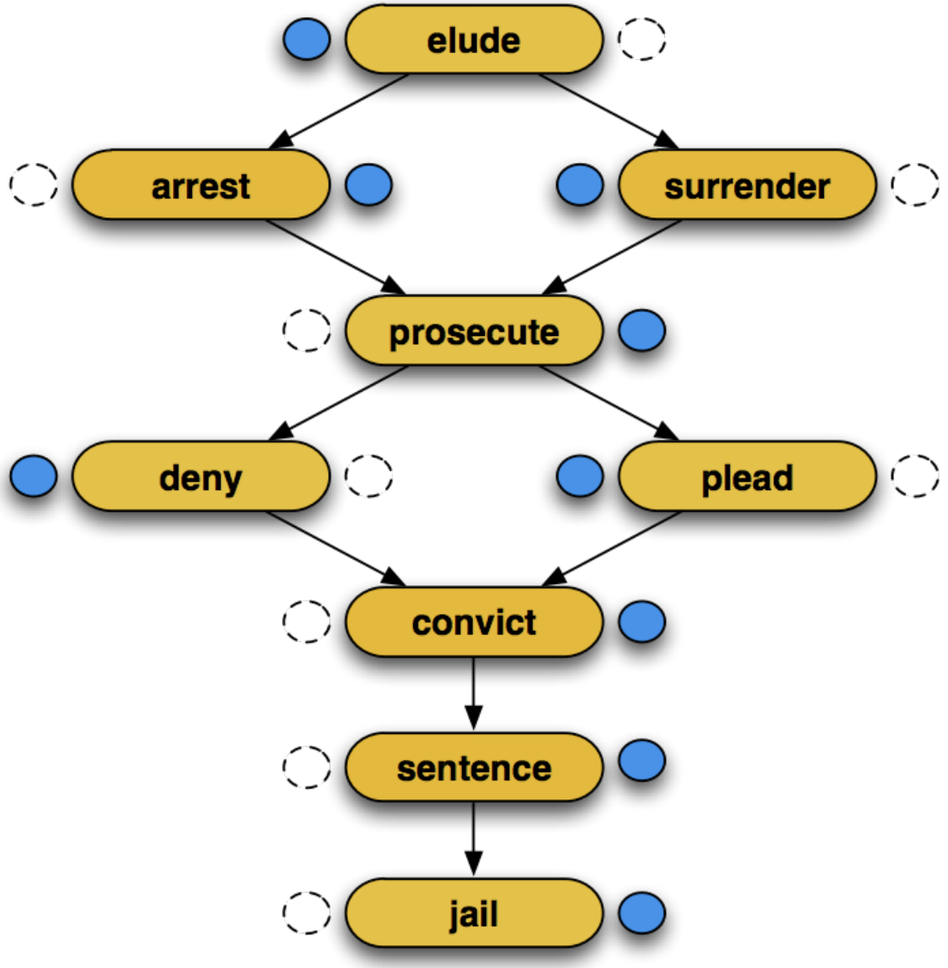
Pointwise Mutual Information

$$\text{pmi}(x,y) = \log \frac{p(x,y)}{p(x)p(y)}$$

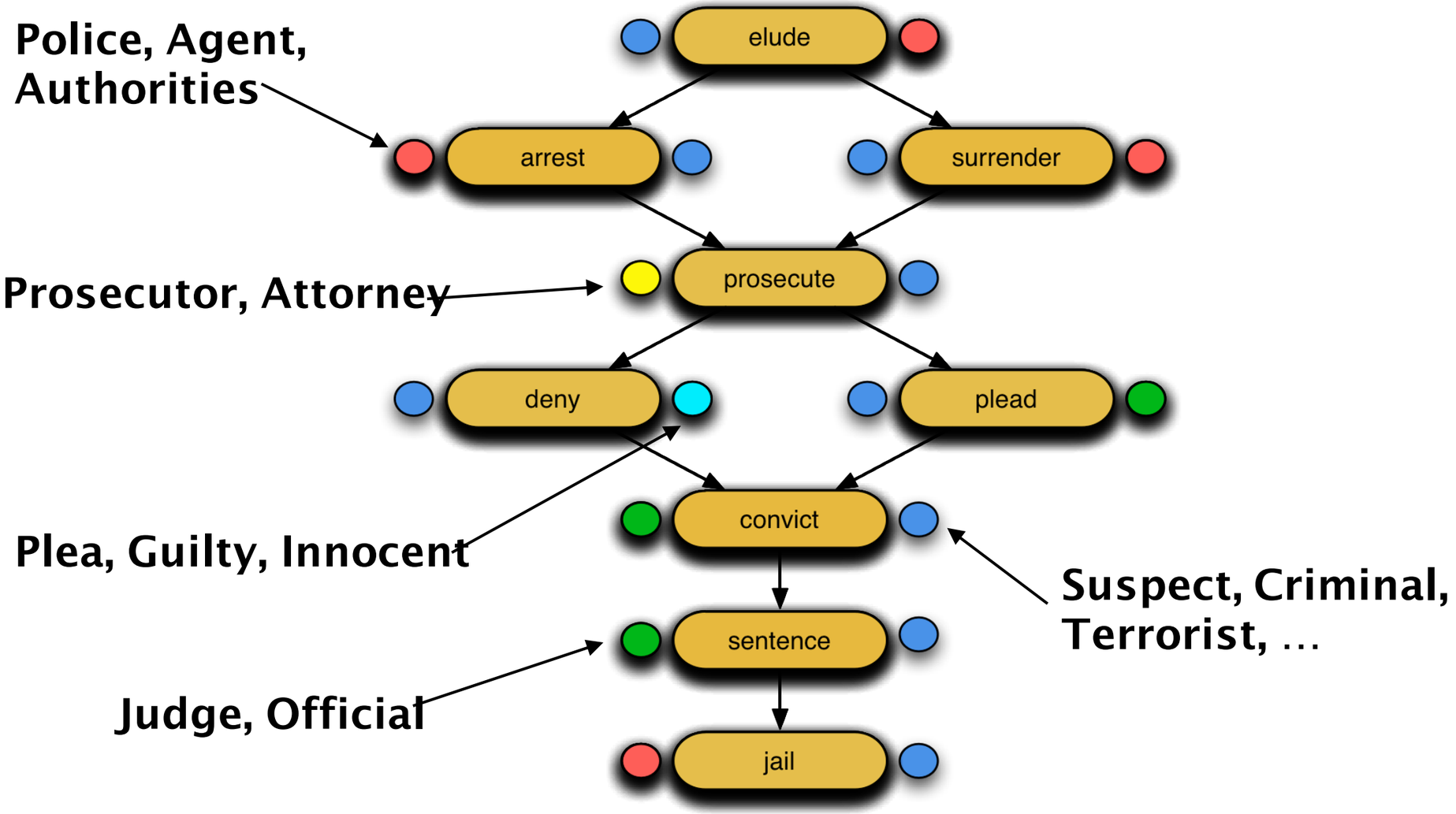
Linking grouped events



Resulting Chain Example

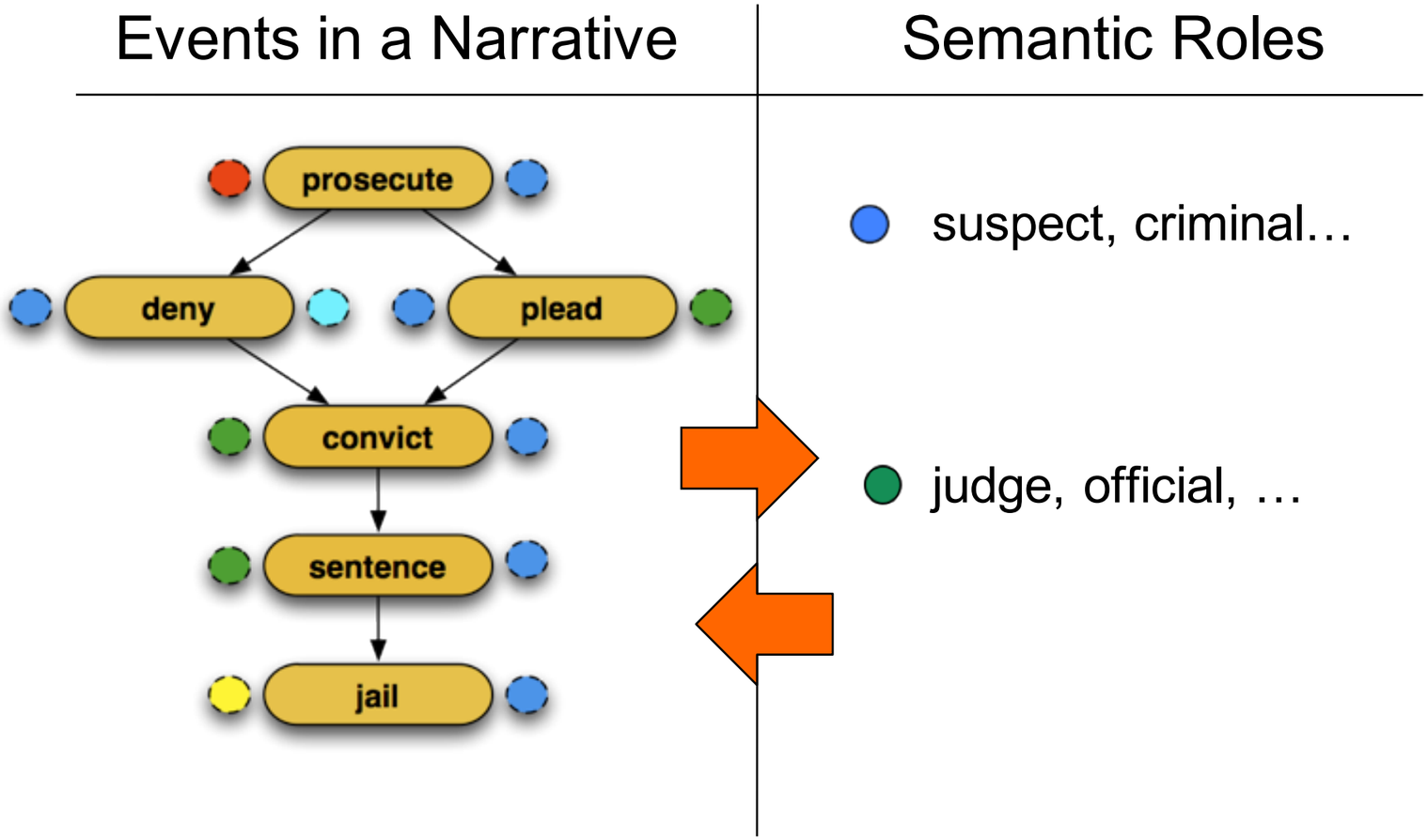


Goal: A Schema with its Arguments

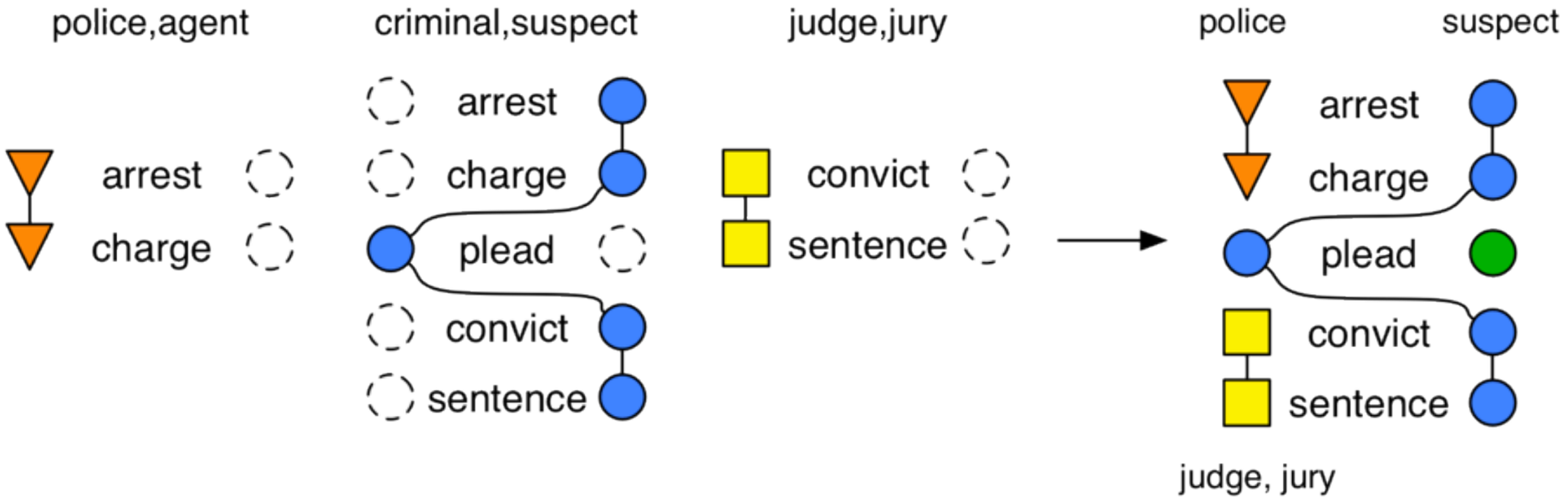


Two Joint Tasks

Nathanael Chambers and Dan Jurafsky. 2009. Unsupervised Learning of Narrative Schemas and their Participants. Proceedings of ACL-IJCNLP 2009.



Narrative Schemas



Second cue for learning meaning from text: Distributional context

hurricane **was downgraded**
typhoon **was downgraded**

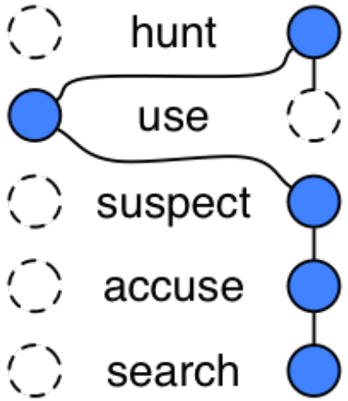
hurricane **is-related-to** typhoon

hurricane **struck**
typhoon **devastated**…

strike **is-related-to** **devastate**

Joint Learning of Events and Roles

- Use **verb relations** to induce **semantic roles**.
  - Link head nouns of coreferring arguments.



= criminal
suspect
man
student
immigrant
person

- Use **semantic roles** to learn **verb relations**.
  - Include argument-role-type counts in relation scores.

$$sim(e_i, e_j) \Rightarrow sim(e_i, e_j, a)$$

Training Data

- NYT portion of the Gigaword Corpus
  - David Graff. 2002. *English Gigaword*. Linguistic Data Consortium.
  - 1.2 million documents

Learned Examples

NYT portion of the Gigaword Corpus
David Graff. 2002. *English Gigaword*. LDC.
1.2 million documents

- court, judge, justice, panel, Osteen, circuit, nicolau, sporkin, majority
- law, ban, rule, constitutionality, conviction, ruling, lawmaker,

Learned Examples

- company, inc, corp, microsoft, iraq, co, unit, maker, …
- drug, product, system, test, software, funds, movie, …

Comparison to FrameNet

- Narrative Schemas
  - Focuses on events that occur together in a narrative.

- FrameNet
  - Focuses on events that share core roles.

Comparison to FrameNet

- Narrative Schemas
  - Focuses on events that occur together in a narrative.
  - Schemas represent larger situations.

- FrameNet
  - Focuses on events that share core roles.
  - Frames typically represent single events.

Conclusion

- Semantic roles are really only a piece of larger knowledge structures
- This background knowledge (scripts, frames, schemata) can be learned from text
- Lots of fun open problems in this line of work!