Statistical Script Learning with Multi-Argument Events

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Statistical Scripts

Statistical Scripts are models of co-occurring events which allow us to **infer additional events** from a document.

Sally strained her back while planting roses.

↓

Script inference system

↓

Sally watered the roses.	[0.9]
Sally dug.	[0.5]
Sally laid down.	[0.4]

Multi-Argument Events

How to represent events?

Bob *called* ***Alice*** *but* ***she*** *ignored* ***him****.*

Previous work uses a **protagonist model** with **verb-dependency pairs** [1; 2]:

Bob	Alice
(call, subj)	(call, obj)
(ignore, obj)	(ignore, subj)

Instead, we use **multi-argument events:**

call(B, A)
ignore(A, B)

These events capture **entity interactions** that we couldn't before.

Learning

- Run **parser** and **coreference** engine on unlabeled corpus.
- Extract one event sequence per document.
- Abstract entity mentions into **variables**, with one variable per coreference class.
- Count co-occurrences between events *a* and *b* to estimate *P*(*a*,*b*).

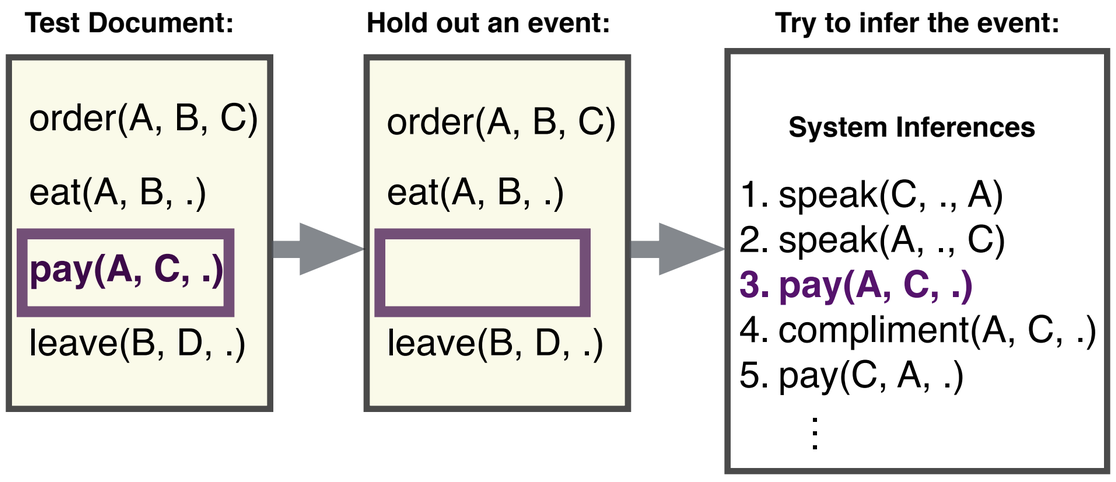
Inference

Following [2], infer event *a* at position *p* by maximizing probability of *a* following earlier events and preceding later events:

$$S(a) = \sum_{i=1}^{p-1} \log P(a|a_i) + \sum_{i=p+1}^{|A|} \log P(a_i|a)$$

Evaluation

Narrative Cloze [1; 2]**:** evaluate a system by inferring held-out events from documents.



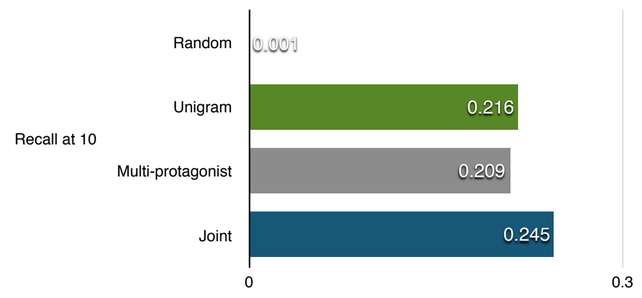
…a good script system should be able to **reconstruct documents' event structure.**

Results

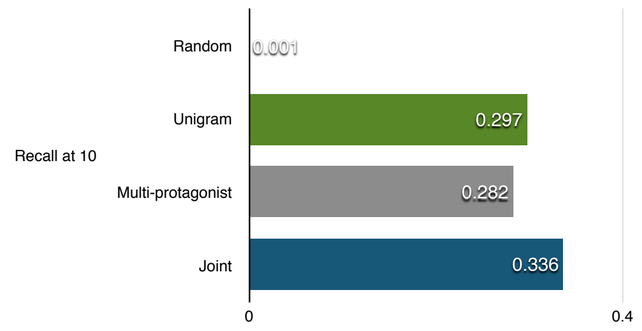
Systems compared:

- **Random**: guess events at random.
- **Unigram**: guess events according only to frequency
- **Multi-protagonist**: combine inferred (verb, dependency) pairs into multi-argument events.
- **Joint**: directly model multi-argument events.

Inferring Held-out Multi-Argument Events:



Inferring Held-out Verb-dependency pairs:



Directly modeling entity interactions provides **better prediction** of held-out events, in **both** multi-argument and verb-dependency-pair inference.

[1] Nathanael Chambers and Daniel Jurafsky. 2008. Unsupervised learning of narrative event chains. (ACL 2008).

[2] Bram Jans, Steven Bethard, Ivan Vulić, and Marie Francine Moens. 2012. Skip n-grams and ranking functions for predicting script events. (EACL 2012).

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