A neural coreference system for conversational agents

HuggingFace Inc.
Coreference resolution?

- Linking together mentions that relates to real world entities

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rrr my dad is yelling at me again haha

U don't have one 😞

Yes I do!

What's his name

My father name is a secret

You don't have one see I was right

You're right, I don't
Coreference resolution?

- Linking together mentions that relates to real world entities
Coreference resolution?

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My sister has a friend called John

Really, tell me more about him

She thinks he is so funny 😅
Coreference resolution?

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Example:
- My sister has a friend called John
- Really, tell me more about him
- She thinks he is so funny 😄
Coreference resolution

- Linking together mentions that relates to real world entities
Coreference resolution?

- Linking together mentions that relates to real world entities

Try it at: https://huggingface.co/coref/
Algorithm

1. We extract a series of **mentions** potentially referring to real world entities

- **Rule-based** (our approach):
  
  Parse the input and apply a set of rules to extract segments of the sentence => 90% recall

- **Neural-network-based** (Lee et al. EMNLP 2017):
  
  Train a neural net to score potential segments of the sentence.
Algorithm

2. For each pair of mentions, we compute a set of about twenty features:
   - word embeddings in/around each mention,
   - distance between mentions,
   - boolean features related to the speakers in dialog (same speakers, exact string match)

3. We find the most likely antecedent for each mention by comparing each pair => pairwise ranking

- Network is pre-trained with maximum likelihood and trained on a non-probabilistic slack-rescaled max-margin objective
Trained features

- Left: **Initial** word embeddings (PCA of pre-trained word2vec)
- Right: **trained** word embeddings (PCA)
Trained features

- Left: **Initial** word embeddings (PCA of pre-trained word2vec)
- Right: **trained** word embeddings (PCA)
- Trained on OntoNotes Corpus – formal language
Open-sourced for the conversational agents community

- Interesting versus alternative coreference solutions (Stanford’s CoreNLP)
  - Modular Python module VS monolithic Java bloc => easier to integrate in high-throughput distributed systems
  - Can makes use of speakers informations in a dialog => better performances in dialog systems
  - Easily adapt to evolving vocabulary: compute embeddings for unknown words on the fly from definitions => better performance in challenging language field (teenage language, slang, …)
  - Based on spaCy ultra-fast cython/python parser => Numpy/pyTorch style, pythonic approach

- Get it on https://github.com/huggingface and try it at: https://huggingface.co/coref/