

# Coreference Resolution

## What is Coreference Resolution?

识别一段text中指代相同的entity。

- Identify all **mentions** that refer to the same real world entity

Barack Obama nominated **Hillary Rodham Clinton** as his **secretary of state** on Monday. He chose **her** because **she** had foreign affairs experience as a former **First Lady**.

例子:

A couple of years later, **Vanaja** met **Akhila** at the local park. **Akhila's son Prajwal** was just two months younger than **her son Akash**, and they went to the same school. For the pre-school play, **Prajwal** was chosen for the lead role of the naughty child Lord Krishna. **Akash** was to be a tree. **She** resigned **herself** to make **Akash** the best tree that anybody had ever seen. **She** bought **him** a brown T-shirt and brown trousers to represent the tree trunk. Then **she** made a large cardboard cutout of a tree's foliage, with a circular opening in the middle for **Akash's** face. **She** attached red balls to it to represent fruits. It truly was the **nicest tree**.

From The Star by Shruthi Rao, with some shortening.

coreference resolution的应用:

- information extraction/ qa/ summarization
- machine translation, 用cr可以具体知道具体指代的主语

- languages have different features for gender, number, dropped pronouns, etc.



- dialogue systems

“Book tickets to see **James Bond**”

“**Spectre** is playing near you at 2:00 and **3:00** today. **How many tickets** would you like?”

“**Two** tickets for the showing at **three**”

## Two Steps

1. mention detection: 识别出所有的mentions
2. mention cluster: 对mentions进行聚类

## Mention Detection

- Mention: span of text referring to some entity
- Three kinds of mentions:

### 1. Pronouns

- I, your, it, she, him, etc.

### 2. Named entities

- People, places, etc.

### 3. Noun phrases

- “a dog,” “the big fluffy cat stuck in the tree”

## 1. Pronouns

- Use a part-of-speech tagger

## 2. Named entities

- Use a NER system (like hw3)

## 3. Noun phrases

- Use a parser (especially a constituency parser – next week!)

有一些bad mentions, 如"It is sunny"的it并不是mention。可以通过train一个二分类器判断是否计入mention, 或者cr结束后再判断丢弃。

用neural方法, 可以end2end找出mention, 甚至end2end完成cr。

# Coreference (linguistics)

anaphora是在同一段text中的指代; coreference是指在这个世界上, 某两个词就是同一个指代。

## Anaphora vs Coreference

- Coreference with named entities

text

Barack Obama

Obama

world



- Anaphora

text

Barack Obama

he

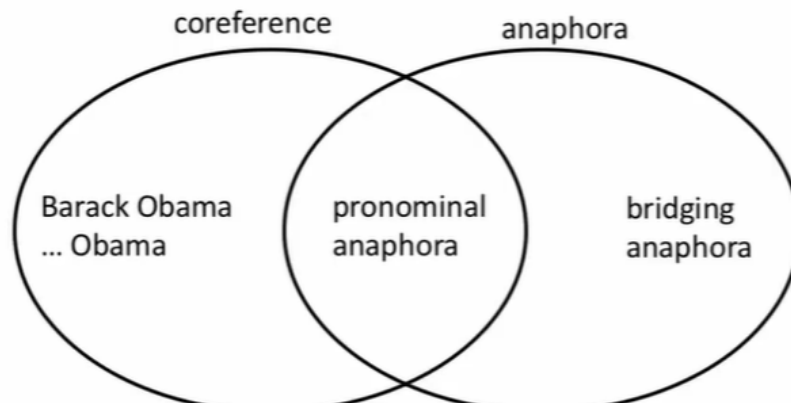
world



anaphoric relations不一定是coreference的。

We went to see *a concert* last night. *The tickets* were really expensive.

- This is referred to as **bridging anaphora**.



23

## Four Kinds of Coreference Models

### Knowledge-based

Hobbs algorithm

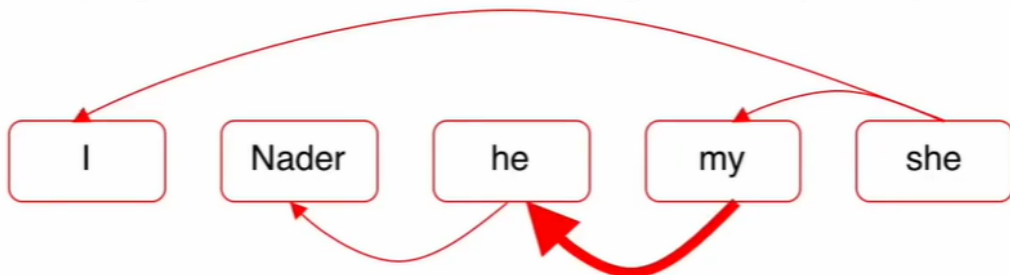
### Mention Pair

每一对mentions，用一个二分类器前者是antecedent的概率。

## Mention Pair Test Time

- Coreference resolution is a clustering task, but we are only scoring pairs of mentions... what to do?
- Pick some threshold (e.g., 0.5) and add **coreference links** between mention pairs where  $p(m_i, m_j)$  is above the threshold
- Take the transitive closure to get the clustering

*"I voted for **Nader** because **he** was most aligned with **my** values," **she** said.*



Adding this extra link would merge everything into one big coreference cluster!

45

## Mention Ranking

- Assign each mention its highest scoring candidate antecedent according to the model
- Dummy NA mention allows model to decline linking the current mention to anything ("singleton" or "first" mention)



only add highest scoring  
coreference link

$$p(\text{NA}, \text{she}) = 0.1$$

$$p(\text{I}, \text{she}) = 0.5$$

$$p(\text{Nader}, \text{she}) = 0.1$$

$$p(\text{he}, \text{she}) = 0.1$$

$$p(\text{my}, \text{she}) = 0.2$$

Apply a softmax over the scores for  
candidate antecedents so  
probabilities sum to 1

46

