Reference Resolution #1

CSCI-GA.2590

Ralph Grishman
Reference Resolution: Objective

• Identify all phrases which refer to the same real-word entity
  – first, within a single document
  – later, also across multiple documents
Terminology

*referent*: real-world object referred to

*referring expression* [mention]: a phrase referring to that object

Mary was hungry; she ate a banana.
Terminology

- **coreference**: two expressions referring to the same thing

  - $\text{Mary was hungry;} \quad \text{she ate a banana.}$
    - antecedent
    - anaphor
    - (prior expression)
    - (following expression)

  - So we also refer to process as *anaphora resolution*
Types of referring expressions

- definite pronouns (he, she, it, ...)
- indefinite pronouns (one)
- definite NPs (the car)
- indefinite NPs (a car)
- names
Referring Expressions: pronouns

Definite pronouns: he, she, it, …

• generally anaphoric
  – Mary was hungry; she ate a banana

• pleonastic (non-referring) pronouns
  – It is raining.
  – It is unlikely that he will come.

• pronouns can represent bound variables in quantified contexts:
  – Every lion finished its meal.
Referring Expressions: pronouns

Indefinite pronouns (one)
• refers to another entity with the same properties as the antecedent
  – Mary bought an IPhone6.
  – Fred bought one too.
  – *Fred bought it too.
• can be modified
  – Mary bought a new red convertible.
  – Fred bought a used one.
    = a used red convertible
    (retain modifiers on antecedent which are compatible with those on anaphor)
Referring Expressions: pronouns

Reflexive pronouns (himself, herself, itself)

• used if antecedent is in same clause
  – I saw myself in the mirror.
Referring expressions: NPs

NPs with definite determiners ("the")
• reference to uniquely identifiable entity
• generally anaphoric
  – I bought a Ford Fiesta. The car is terrific.
• but may refer to a uniquely identifiable common noun
  – I looked at the moon
  – The president announced ...
• or a functional result
  – The sum of 4 and 5 is 9.
  – The price of gold rose by $4.
Referring expressions: NPs

NPs with indefinite determiners ("a")
• generally introduces a new ‘discourse entity’
• may also be generic:
  – A giraffe has a long neck.
Referring expressions: names

• subsequent references can use portions of name:
  – Fred Frumble and his wife Mary bought a house. Fred put up a hammock.
Complications

• Cataphora
• Bridging anaphora
• Zero anaphora
• Non-NP anaphora
Cataphora

• Pronoun referring to a following mention:
  – When she entered the room, Mary looked around.
Bridging Anaphora

• Reference to related object
  – Entering the room, Mary looked at the ceiling.
Zero Anaphora

• many languages allow subject omission, and some allow omission of other arguments (e.g., Japanese)
  – these can be treated as zero (implicit) anaphors
    • similar resolution procedures
  – some cases of bridging anaphora can be described in terms of PPs with zero anaphors:
    • "IBM announced the appointment of Fred as president [of IBM]."
Non-NP Anaphora

• Pronouns can also refer to events or propositions:
  – Fred claimed that no one programs in Lisp. That is ridiculous.