

Chart Parsing, Part 2

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Review Chart Parsing

Left Recursion and Ambiguity

Reading

Charts and Edges

- ▶ A **chart** records hypotheses about possible constituents;
- ▶ it contains a set of **edges**.
- ▶ Each edge has information about
 - ▶ start index of the constituent,
 - ▶ end index,
 - ▶ the hypothesized type of the constituent and its sub-constituents
- ▶ NLTK: $[A \rightarrow B C]@[i:j]$
- ▶ The content of an edge takes the form of a dotted rule:
 $A \rightarrow \alpha \bullet \beta$:
 - ▶ α is what we've **found** so far,
 - ▶ β is what we still **need** in order to complete an A.

Chart Parser Rules

- ▶ A chart parser **rule** (or function) adds new edges to the chart.
- ▶ A chart parsing **strategy** defines a set of rules.
- ▶ **Top Down**
 - ▶ top down initialization rule
 - ▶ top down predictor rule
 - ▶ fundamental rule (completer)
- ▶ **Bottom Up**
 - ▶ bottom up predictor rule
 - ▶ fundamental rule (completer)

Fundamental Rule

- ▶ Fundamental Rule is used by both strategies.
- ▶ If the chart contains
 - ▶ $A \rightarrow \alpha \bullet B \gamma, [i, j]$ and
 - ▶ $C \rightarrow \beta [j, k]$, then add
 - ▶ $A \rightarrow \alpha B \bullet \gamma, [i, k]$

Top Down Predictor Rule

- ▶ If the chart contains
 - ▶ $A \rightarrow \alpha \bullet C \beta, [i, j]$ then
 - ▶ for each production $C \rightarrow \gamma$, add
 - ▶ $C \rightarrow \bullet \gamma, [j, j]$

Bottom Up Predictor Rule

- ▶ If the chart contains
 - ▶ $A \rightarrow \alpha \bullet, [i, j]$ then
 - ▶ for each production $B \rightarrow A\beta$, add
 - ▶ $B \rightarrow \bullet A\beta, [i, j]$

Examples: Left Recursion

Assume we are parsing NP *a flight from Denver to Boston* with the following rules:

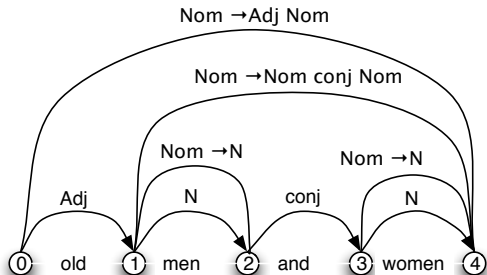
$NP \rightarrow NP PP$

$NP \rightarrow Det Nom$

$NP \rightarrow Proper-Noun$

- ▶ We construct the state $(NP \rightarrow \bullet NP PP, [0,0])$ and add it to $chart[0]$
- ▶ The Predictor rule requires us to find a rule which expands the (non-lexical) category immediately to the right of the dot.
- ▶ Pick the first rule above, and add the state $(NP \rightarrow \bullet NP PP, [0,0])$.
- ▶ But this is already in the chart, so we don't add it again.

Examples: Global Ambiguity



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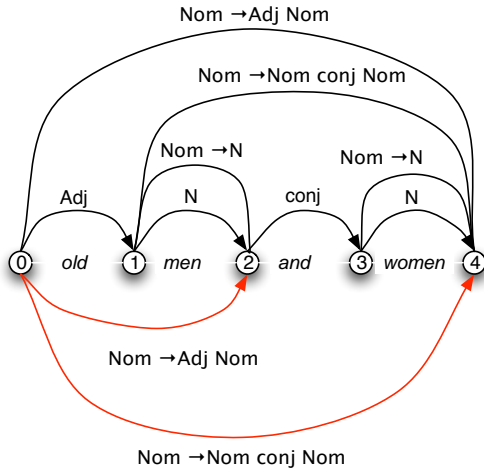


Chart Parser Demo

```
>>> from nltk_lite.draw.chart import demo  
>>> demo()
```

Reading

- ▶ Read section 10.4 of J&M
- ▶ Read the NLTK-Lite Tutorial on Chart Parsing