Introduction to NLP

Parts of speech
Syntactic categories

• Substitution test:

\[
Nathalie \text{ likes } \left\{ \begin{array}{l}
\text{black} \\
\text{Persian} \\
\text{tabby} \\
\text{small}
\end{array} \right\} \text{ cats.}
\]

• Open (lexical) and closed (functional) categories:

\[
\begin{array}{l}
\text{No-fly-zone} \\
\text{twerk}
\end{array} \quad \begin{array}{l}
\text{the} \\
\text{in}
\end{array}
\]
Example

The dog chased the yellow bird.

- Parts of speech
  - eight (or so) general types
  - nouns, verbs, adjectives...
Nouns

- Examples
  - dog, tree, computer, idea

- Nouns vary in
  - number (singular, plural)
  - gender (masculine, feminine, neuter)
  - case (nominative, genitive, accusative, dative)

- Case example in Latin
  - Singular: puer (nominative), puerum (accusative), puerī (genitive)
  - Plural: puerī (nominative), puerōs (accusative), puerōrum (genitive)

- Gender example in German
  - Mädchen (neuter gender)
Jabberwocky (Lewis Carroll)

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

• What are the parts of speech for the words in bold?
Answers

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

- **Wabe, borogoves**
  - Nouns (after “the”)

- **brillig**
  - adjective?
  - noun? (“noon”)

- **mimsy**
  - adjective

- **slightly toves**
  - adjective+noun?
  - noun+verb? (“the bell tolls”)

- **mome raths outgrabe**
  - Adjective+noun+verb?
  - Noun+verb+adverb? (“birds fly outside”)

Why is this an Important Example?

- Computers see text that they don’t really understand.
- They have to use some prior knowledge.
- They reason probabilistically.
- They use context.
- They can be wrong.
Pronouns

• Examples
  – she, ourselves, mine

• Pronouns vary in
  – person
  – gender
  – number
  – case (in English: nominative, accusative, possessive, 2nd possessive)

• Reflexive and anaphoric forms
  – herself, each other

Samantha gave her a haircut.
Samantha gave herself a haircut.
Determiners and Adjectives

• Determiners
  – Articles
    • the, a
  – Demonstratives
    • this, that

• Adjectives
  – describe properties
  – attributive and predicative adjectives
  – agreement
    • in gender, number
  – comparative and superlative forms
    • derivative and periphrastic
  – positive form
Verbs

- **Describe**
  - actions, activities, and states (*throw, walk, have*)

- **English**
  - four verb forms

- **Tense**
  - present, past, future

- **Other inflection**
  - number (including Dual in Slovenian, Arabic), person

- **Forms**
  - gerunds and infinitive

- **Aspect**
  - progressive, perfective

- **Voice**
  - active, passive
Verbs

• Participles, auxiliaries
• Arguments:
  – The dog sleeps (intransitive)
  – The dog chased the cat (transitive)
  – Mary gave the dog a bone (ditransitive)
• Irregular verbs
  – sleep, slept
• Richer inflections
  – e.g., French, Finnish
  – cases in Russian, Greek, Tamil, Latin
### Verb Conjugation in French

<table>
<thead>
<tr>
<th>Tense</th>
<th>1st Person</th>
<th>2nd Person</th>
<th>3rd Person</th>
<th>Plural</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Present</strong></td>
<td>je vais I go</td>
<td>tu vas you go</td>
<td>il va he goes</td>
<td>nous allons we go</td>
</tr>
<tr>
<td><strong>Past</strong></td>
<td>je suis allé(e) I went</td>
<td>tu es allé(e) you went</td>
<td>il est allé(e) he went</td>
<td>nous sommes allé(e)s we went</td>
</tr>
<tr>
<td><strong>Imperfect</strong></td>
<td>j'allais I used to go</td>
<td>tu allais you used to go</td>
<td>il allait he used to go</td>
<td>nous allions we used to go</td>
</tr>
<tr>
<td><strong>Conditional</strong></td>
<td>j'irais I would go</td>
<td>tu irais you would go</td>
<td>il irait he would go</td>
<td>nous irions we would go</td>
</tr>
<tr>
<td><strong>Future</strong></td>
<td>j'irai I will go</td>
<td>tu iras you will go</td>
<td>il ira he will go</td>
<td>nous irons we will go</td>
</tr>
<tr>
<td><strong>Subjunctive</strong></td>
<td>que j'aille that I go</td>
<td>que tu ailles that you go</td>
<td>qu'il aille that he go</td>
<td>que nous allions that we go</td>
</tr>
</tbody>
</table>
Other Parts of Speech

- **Adverbs**
  - happily, here, never
- **Prepositions**
  - of, through, in
- **Particles**
  - Phrasal verbs
  - the plane took off, take it off
- **Particles vs. prepositions**
  - *She ran up a bill/hill*
Other Parts of Speech

- Coordinating conjunctions
  - and, or, but

- Subordinating conjunctions
  - if, because, that, although

- Interjections
  - Ouch!
Sample Part of Speech Tags

NN /* singular noun */
IN /* preposition */
AT /* article */
NP /* proper noun */
JJ /* adjective */
, /* comma */
NNS /* plural noun */
CC /* conjunction */
RB /* adverb */
VB /* un-inflected verb */
VBN /* verb +en (taken, looked (passive, perfect)) */
VBD /* verb +ed (took, looked (past tense)) */
CS /* subordinating conjunction */