Practical Grammar Engineering using HPSG

Exercises day4: Modifiers and Agreement

Modifiers

- adjectives: a *good* book
- PPs:
  - modifying nouns: a book *on the table*
  - modifying VPs: The dog barks *near the cat*.

Figure 1: Lexical entry of the adjective “big”

$$
\left[\begin{array}{ll}
\text{STEM} & \left\langle \text{“big”} \right\rangle \\
\text{SYNSEM} & \left[\begin{array}{ll}
\text{LOCAL} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{HEAD} & \left[\begin{array}{ll}
\textit{adj} & \\
\text{MOD} & \left\langle \left[\begin{array}{ll} \text{LOCAL} & \left[\begin{array}{l} \text{CAT} \mid \text{VAL} \mid \text{COMPS} \; \langle\rangle \\ \text{CONT} \mid \text{HOOK} \left[\begin{array}{ll} \text{LTOP} & \boxed{0} \\ \text{INDEX} & \boxed{1} \end{array}\right] \end{array}\right] \end{array}\right] \right\rangle
\end{array}\right] \\
\text{VAL} & \left[\begin{array}{ll}
\text{SUBJ} & \langle\rangle \\
\text{SPR} & \langle\rangle \\
\text{SPEC} & \langle\rangle \\
\text{COMPS} & \langle\rangle
\end{array}\right]
\end{array}\right] \\
\text{CONT} & \left[\begin{array}{ll}
\text{HOOK} & \left[\begin{array}{ll} \text{LTOP} & \boxed{0} \\ \text{INDEX} & \boxed{2}\ \textit{event} \end{array}\right] \\
\text{RELS} & \left\langle !\ \boxed{3} \left[\begin{array}{ll}
\textit{adj-relation} & \\
\text{LBL} & \boxed{0} \\
\text{PRED} & \text{“big\_rel”} \\
\text{ARG0} & \boxed{2} \\
\text{ARG1} & \boxed{1}
\end{array}\right] ! \right\rangle \\
\text{HCONS} & \left\langle !\ ! \right\rangle
\end{array}\right]
\end{array}\right] \\
\text{LKEYS} \mid \text{KEYREL} \; \boxed{3} &
\end{array}\right]
\end{array}\right]
$$

Figure 2: Lexical entry of the preposition “near”

$$
\begin{bmatrix}
\text{STEM} \left\langle \text{“near”} \right\rangle \\
\text{SYNSEM} \begin{bmatrix}
\text{LOCAL} \begin{bmatrix}
\text{CAT} \begin{bmatrix}
\text{HEAD} \begin{bmatrix}
\textit{prep} \\
\text{MOD} \left\langle \begin{bmatrix}
\text{LOCAL} \begin{bmatrix}
\text{CAT} \mid \text{VAL} \mid \text{COMPS} \langle\rangle \\
\text{CONT} \mid \text{HOOK} \begin{bmatrix} \text{LTOP} & \boxed{0} \\ \text{INDEX} & \boxed{1} \end{bmatrix}
\end{bmatrix}
\end{bmatrix} \right\rangle
\end{bmatrix} \\
\text{VAL} \begin{bmatrix}
\text{SUBJ} & \langle\rangle \\
\text{SPR} & \langle\rangle \\
\text{SPEC} & \langle\rangle \\
\text{COMPS} & \left\langle \begin{bmatrix} \text{LOCAL} \mid \text{CONT} \mid \text{HOOK} \mid \text{INDEX} \ \boxed{2} \end{bmatrix} \right\rangle
\end{bmatrix}
\end{bmatrix} \\
\text{CONT} \begin{bmatrix}
\text{HOOK} \begin{bmatrix} \text{LTOP} & \boxed{0} \\ \text{INDEX} & \boxed{3}\ \textit{event} \end{bmatrix} \\
\text{RELS} \left\langle !\ \boxed{4} \begin{bmatrix}
\textit{prep-mod-relation} \\
\text{LBL}\ \boxed{0} \\
\text{PRED “\_near\_rel”} \\
\text{ARG0}\ \boxed{3} \\
\text{ARG1}\ \boxed{1} \\
\text{ARG2}\ \boxed{2}
\end{bmatrix} ! \right\rangle \\
\text{HCONS} \left\langle !\ ! \right\rangle
\end{bmatrix}
\end{bmatrix} \\
\text{LKEYS} \mid \text{KEYREL}\ \boxed{4}
\end{bmatrix}
\end{bmatrix}
$$

Figure 3: Rule for adjectives modifying nouns

$$
\left[\begin{array}{ll}
\multicolumn{2}{l}{\textbf{a-mod-rule}} \\
\text{SYNSEM}\,|\,\text{LOCAL} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{HEAD} & \boxed{0}\ \textit{noun} \\
\text{VAL} & \left[\begin{array}{l}
\text{SUBJ}\ \boxed{1} \\
\text{SPR}\ \boxed{2} \\
\text{COMPS}\ \langle\rangle
\end{array}\right]
\end{array}\right] \\
\multicolumn{2}{l}{\text{CONT}\,|\,\text{HOOK}\ \boxed{3}} \\
\multicolumn{2}{l}{\text{AGR}\ \boxed{4}}
\end{array}\right] \\
\text{HEAD-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOCAL} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{ll}
\text{HEAD} & \boxed{0} \\
\text{VAL}\ \boxed{5} & \left[\begin{array}{l}
\text{SUBJ}\ \boxed{1} \\
\text{SPR}\ \boxed{2} \\
\text{COMPS}\ \textit{olist}
\end{array}\right]
\end{array}\right] \\
\multicolumn{2}{l}{\text{CONT}\,|\,\text{HOOK}\ \boxed{3}} \\
\multicolumn{2}{l}{\text{AGR}\ \boxed{4}}
\end{array}\right] \\
\text{NON-HEAD-DTR}\,|\,\text{SYNSEM}\,|\,\text{LOCAL}\,|\,\text{CAT}\,|\,\text{HEAD} & \left[\begin{array}{ll}
\multicolumn{2}{l}{\textit{adj}} \\
\text{MOD} & \left\langle \left[\begin{array}{ll}
\text{LOCAL} & \left[\begin{array}{ll}
\text{CAT} & \left[\begin{array}{l}
\text{HEAD}\ \boxed{0} \\
\text{VAL}\ \boxed{5}
\end{array}\right] \\
\multicolumn{2}{l}{\text{CONT}\,|\,\text{HOOK}\ \boxed{3}} \\
\multicolumn{2}{l}{\text{AGR}\ \boxed{4}}
\end{array}\right]
\end{array}\right] \right\rangle
\end{array}\right]
\end{array}\right]
$$

Agreement

- Subject - verb agreement
  - The dog barks.
  - The dogs bark.
  - *The dog bark.
  - *The dogs barks.
- Determiner - adjective - noun agreement
  - eine gute Dame
  - ein gutes Kind
  - *ein gutes Dame
  - *eine gutes Kind

Person, number and gender

```
ref-ind &
  [ PNG png ].

png := *avm* &
  [ PN pernum,
    GEN gender ].

3sg := pernum.
non3sg := pernum.
```

Agreement information on the index of the pronoun "he":

$$\begin{bmatrix} \text{PNG} \begin{bmatrix} \text{PN 3sg} \\ \text{GEN masc} \end{bmatrix} \end{bmatrix}$$

Figure 4: Agreement information in the verb word “barks”

$$
\begin{bmatrix}
\text{STEM} \left\langle \text{“barks”} \right\rangle \\
\text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix} \text{CAT} \mid \text{HEAD} \mid \text{verb} \\ \text{CONT} \begin{bmatrix} \text{HOOK} \mid \text{INDEX}\ \boxed{2}\ \text{event} \\ \text{RELS} \left\langle \begin{bmatrix} \text{PRED} & \text{“\_bark\_rel”} \\ \text{ARG0} & \boxed{2} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{AGR} \mid \text{PNG} \mid \text{PN}\ \text{3sg} \end{bmatrix}
\end{bmatrix}
$$

Figure 5: Agreement information in the noun word “dogs”

$$
\begin{bmatrix}
\text{STEM} \left\langle \text{“dogs”} \right\rangle \\
\text{SYNSEM} \mid \text{LOCAL} \begin{bmatrix}
\text{CAT} \mid \text{HEAD noun} \\
\text{CONT} \begin{bmatrix}
\text{HOOK} \mid \text{INDEX } \boxed{1} \begin{bmatrix} \text{ref-ind} \\ \text{PNG} \mid \text{PN non3sg} \end{bmatrix} \\
\text{RELS} \left\langle ! \begin{bmatrix} \text{PRED} & \text{“\_dog\_rel”} \\ \text{ARG0} & \boxed{1} \end{bmatrix} ! \right\rangle
\end{bmatrix} \\
\text{AGR } \boxed{1}
\end{bmatrix}
\end{bmatrix}
$$

Figure 6: Subject - verb agreement

$$\begin{bmatrix} \textbf{head-subj-phrase} \\ \text{SYNSEM} \mid \text{LOCAL} \mid \text{AGR } \boxed{1} \\ \text{HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOCAL} \mid \text{AGR } \boxed{1} \\ \text{NON-HEAD-DTR} \mid \text{SYNSEM} \mid \text{LOCAL} \mid \text{AGR } \boxed{1} \end{bmatrix}$$

Figure 7: Agreement and linking in the adjective “big”

$$\begin{bmatrix} \text{STEM} & \left\langle \text{“big”} \right\rangle \\ \text{SYNSEM} & \begin{bmatrix} \text{LOCAL} & \begin{bmatrix} \text{CAT}\,|\,\text{HEAD} & \begin{bmatrix} \text{adj} & \\ \text{MOD} & \left\langle \begin{bmatrix} \text{LOCAL}\,|\,\text{CONT}\,|\,\text{HOOK}\,|\,\text{INDEX}\ \boxed{1} \end{bmatrix} \right\rangle \end{bmatrix} \\ \text{CONT}\,|\,\text{HOOK}\,|\,\text{INDEX}\ \boxed{2}\ \text{event} & \\ \text{AGR}\ \boxed{1} & \end{bmatrix} \\ \text{LKEYS}\,|\,\text{KEYREL} & \begin{bmatrix} \text{PRED} & \text{“\_big\_rel”} \\ \text{ARG0} & \boxed{2} \\ \text{ARG1} & \boxed{1} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$