# Dependency: arguments and adjuncts

# Another important organization notion is the concept of *dependents*.

# NP (noun phrases) are arguments of verbs:

# - via semantic roles arguments are classified in: *agent, patient, instrument, goal*

# - in terms of grammatical relations arguments are classified in: *subject, object*

# In the sentence: *Mary saw the woman at the next table.*

# *Mary* and *the* *woman* are arguments of the verb „saw”.

# *Mary* –agent, *woman* –patient

*Mary* – subject*, woman-* direct object

# Adjuncts are phrases that have less tight link to the verb.

# They are optional and usually tell us the time, place, or manner of the action or

# state that the verb describes:

# She saw the movie *yesterday.*

# She saw the movie *in London.*

# She saw the movie *with a couple of friends.*

# She saw the movie *with great interest.*

# Stanford Parser

### Your sentence: Book a flight to New York.

### Tagging: Book/VB a/DT flight/NN to/TO New/NNP York/NNP ./.

### Parse

(ROOT

(S

(VP (VB Book)

(NP (DT a) (NN flight))

(PP (TO to)

(NP (NNP New) (NNP York))))

(. .)))

### Typed dependencies: Book(1) a(2) flight(3) to(4) New(5) York(6).

|  |  |
| --- | --- |
| Typed dependencies | Typed dependencies, collapsed |
| det(flight-3, a-2)  dobj(Book-1, flight-3)  prep(Book-1, to-4)  nn(York-6, New-5)  pobj(to-4, York-6) | det(flight-3, a-2)  dobj(Book-1, flight-3)  nn(York-6, New-5)  prep\_to(Book-1, York-6) |

### Your sentence: Buy(1) a(2) history(3) book(4) from(5) the(6) library(7).

### Tagging: Buy/VB a/DT history/NN book/NN from/IN the/DT library/NN ./.

|  |  |
| --- | --- |
| Typed dependencies | Typed dependencies, collapsed |
| det(book-4, a-2)  nn(book-4, history-3)  dobj(Buy-1, book-4)  prep(Buy-1, from-5)  det(library-7, the-6)  pobj(from-5, library-7) | det(book-4, a-2)  nn(book-4, history-3)  dobj(Buy-1, book-4)  det(library-7, the-6)  prep\_from(Buy-1, library-7) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Types of dependencies: The **dependencies** are all binary relations: a grammatical relation holds between a **governor**  (also known as a **regent** or a **head**) and a **dependent.** The grammatical relations are defined below:  **abbrev:** **abbreviation modifier**  An abbreviation modifier of an NP is a parenthesized NP that serves to abbreviate the NP  (or to define an abbreviation).  “The Australian Broadcasting Corporation (ABC)" ---- **abbrev**(Corporation, ABC)  **acomp: adjectival complement**  An adjectival complement of a verb is an adjectival phrase which functions as the complement  (like an object of the verb).  “She *looks* very *beautifu*l" ---- **acomp**(looks, beautiful)  **agent: agent**  An agent is the complement of a passive verb which is introduced by the preposition \by" and  does the action.  “The man has been *killed* **by** the *police*" --- **agent**(killed, police)  “Effects *caused* **by** the *protein* are important" --- **agent**(caused, protein) amod: adjectival modifier An adjectival modifier of an NP is any adjectival phrase used to modify the meaning of the NP.  “Sam eats *red meat*" --- **amod**(meat, red)  **appos: appositional modifier**  An appositional modifer of an NP is an NP immediately to the right of the first NP that serves  to define or modify that NP. It includes parenthesized examples.    “Sam, my brother" --- **appos**(Sam, brother)  “Bill (John's cousin)" --- **appos**(Bill, cousin)  **attr: attributive**  An attributive is a WHNP complement of a copular verb such as “to be", “to seem", “to appear".  “What is that?" --- **attr** (is, What)  **aux: auxiliary**  An auxiliary of a clause is a non-main verb of the clause, e.g. modal auxiliary, “be" and “have" in a composed tense.  “Reagan has died" ---- **aux**(died, has)  “He should leave" ---- **aux**(leave, should)  **cc: coordination**  A coordination is the relation between an element of a conjunct and the coordinating conjunction word of the conjunct. We take one conjunct of a conjunction (normally the first) as the head of the conjunction.  “Bill is *big* *and* honest" --- **cc**(big, and)  “They either *ski* *or* snowboard" ---- **cc**(ski, or)  **conj : conjunct**  A conjunct is the relation between two elements connected by a coordinating conjunction, such  as “and", “or", etc. We treat conjunctions asymmetrically: The head of the relation is the first  conjunct and other conjunctions depend on it via the **conj** relation.    “Bill is *big* **and** *honest*" ----- **conj** (big, honest)  “They either *ski* **or** *snowboard*" ----- **conj** (ski, snowboard)  **dep: dependent**  A dependency is labeled as **dep** when the system is unable to determine a more precise dependency relation between two words. This may be because of a weird grammatical construction, a limitation in the Stanford Dependency conversion software, a parser error, or because of an unresolved long distance dependency.  “Then, as *if* to *show* that he could, . . . " --- **dep**(show, if)  **det: determiner**  A determiner is the relation between the head of an NP and its determiner.    “The man is here" ---- **det**(man, the)  “Which book do you prefer?" ---- **det**(book, which)  **dobj : direct object**  The direct object of a VP is the noun phrase which is the (accusative) object of the verb.    “She *gave* me a *raise*" ---- **dobj** (gave, raise)  “They win the lottery" ---- **dobj** (win, lottery)  **iobj : indirect object**  The indirect object of a VP is the noun phrase which is the (dative) object of the verb.    “She *gave* *me* a raise" ---- **iobj** (gave, me)  **nn: noun compound modifier**  A noun compound modifier of an NP is any noun that serves to modify the head noun.  Note that in the current system for dependency extraction, all nouns modify the rightmost noun of the NP.    “Oil price futures" ---- **nn**(futures, oil)  ---- **nn**(futures, price)  **nsubj : nominal subject**  A nominal subject is a noun phrase which is the syntactic subject of a clause. The governor of  this relation might not always be a verb: when the verb is a copular verb, the root of the clause  is the complement of the copular verb, which can be an adjective or noun.    “Clinton defeated Dole" ---- **nsubj** (defeated, Clinton)  “The baby is cute" ---- **nsubj** (cute, baby)  **poss: possession modifer**  The possession modifier relation holds between the head of an NP and its possessive determiner, or a genitive 's complement.  “their offices" ---- **poss**(offces, their)  “Bill's clothes" ---- **poss**(clothes, Bill)  **possessive: possessive modifier**  The possessive modifier relation appears between the head of an NP and the genitive 's.  “Bill's clothes" ---- **possessive**(John, 's)  **prep: prepositional modifier**  A prepositional modifier of a verb, adjective, or noun is any prepositional phrase that serves  to modify the meaning of the verb, adjective, noun, or even another preposition. In the collapsed representation, this is used only for prepositions with NP complements.  “I saw a *cat in* a hat" ---- **prep**(cat, in)  “I *saw* a cat *with* a telescope" ---- **prep**(saw, with)  “He is *responsible for* meals" ---- **prep**(responsible, for)  **predet: predeterminer**  A predeterminer is the relation between the head of an NP and a word that precedes and modifies the meaning of the NP determiner. “*All* the *boys* are here" ----predet(boys, all) **root: root**  The root grammatical relation points to the root of the sentence. A fake node “ROOT" is used as the governor. The ROOT node is indexed with “0", since the indexation of real words in the sentence starts at 1.  “I *love* French fries." ---- **root**(ROOT, love)  “Bill is an honest *man*" ---- **root**(ROOT, man)  **partmod: participial modifier**  A participial modifier of an NP or VP or sentence is a participial verb form that serves to modify the meaning of a noun phrase or sentence.  “*Truffles picked* during the spring are tasty" ---- **partmod**(truffles, picked)  “Bill tried to *shoot demonstrating* his incompetence" ---- **partmod**(shoot, demonstrating)  In the **collapsed representation,** dependencies involving prepositions, conjuncts, as well as information about the referent of relative clauses are collapsed to get **direct dependencies between content words**. This “collapsing" is often useful in simplifying patterns in relation extraction applications.  **Sentence:**  “Bell, based in Los Angeles, makes and distributes electronic, computer and building products.  1 2 3 4 5 6 7 8 9 10 11 12 13  For instance, the dependencies involving the preposition “in" in the above example  will be collapsed into one single relation:  **prep(based-2, in-3) and pobj(in-3, Angeles-5)**  will become: **prep\_in(based-2, Angeles-5)**  **Dependecy tree/graph**:  These dependencies map straightforwardly onto a directed graph representation, in which words in the sentence are nodes in the graph and grammatical relations are edge labels. The Stanford Dependencies (SD) representation is:   |  |  | | --- | --- | | Bell(1), based(2) in(3) Los(4) Angeles(5), makes(6) and(7) distributes (8) electronic(9),  computer(10) and(11) building (12) products(13). | | | nsubj(makes-6, Bell-1)  nsubj(distributes-8, Bell-1)  partmod(Bell-1, based-2)  nn(Angeles-5, Los-4)  prep\_in(based-2, Angeles-5)  root(ROOT-0, makes-6)  conj\_and(makes-6, distributes-8)  amod(products-13, electronic-9)  conj\_and(electronic-9, computer-10)  amod(products-13, computer-10)  conj\_and(electronic-9, building-12)  amod(products-13, building-12)  dobj(makes-6, products-13)  dobj(distributes-8, products-13) |  | |