Outline

- What is Logos Model and Historical Background
- Architecture of Logos Model
- Semantico-Syntactic Abstraction Language (SAL)
- Logos Model Rules
- Rule Matching
- Limitations of Logos Model
- References
Logos Model and Historical Background

- Requested by US Presidency during Vietnamese War
- Four years later after ALPAC Report (Milestone)
- Rule-Based MT System
- Semantico-Syntactic Abstraction Language
- Mental Process
Architecture of Logos Model

John took the things from the kitchen table.
Architecture of Logos Model

- Incremental Approach
- Input analysis RES1,2 and Parse1,2,3,4
- Decoding Tran1,2,3,4
Semantico-Syntatic Abstraction Language (SAL)

- Representation of natural language
- Semantic and Syntactic Information
- WC(Type; Form)
- Hierarchical Organization
### Semantico-Syntactic Abstraction Language (SAL)

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literal level</td>
<td><em>highchair</em></td>
</tr>
<tr>
<td>Head morpheme</td>
<td><em>chair</em></td>
</tr>
<tr>
<td>SAL subset</td>
<td>COsupp (‘concrete noun’, ‘support surface’)</td>
</tr>
<tr>
<td>SAL set</td>
<td>COfunc (‘concrete noun’, ‘functional device’)</td>
</tr>
<tr>
<td>SAL superset</td>
<td>CO (‘concrete noun’)</td>
</tr>
<tr>
<td>Word class</td>
<td>N</td>
</tr>
</tbody>
</table>
(1) a. I like the **ham** and **cheese** **sandwiches**.
   b. *J’aime les sandwiches de jambon et de fromage.*
   c. *Mir gefallen Schinken- und Käsestullen.*

(2) a. I never go to that **bank** or **TV store**.
   b. *Je ne vais jamais à cette banque ou à ce magasin télévision*
   c. *Ich gehe nie zu jener Bank oder Fern seh Lager.*

(3) \[
N(X; SG) \text{ CJ(CRD; u) } N(X; SG) \ast N(u; u) \rightarrow NP
\]
Semantico-Syntatic Abstraction Language (SAL)

(4) a. corn eating insects
   b. *les insectes qui mangent le maïs*
      THE INSECTS WHICH EAT THE CORN
   c. *Maisessen-Insekten*
      CORN-EAT INSECTS

(5) a. insects eating corn
   b. *les insectes qui mangent du maïs*
      THE INSECTS WHICH EAT OF-THE CORN
   c. *Insekten, die Mais fraßen*
      INSECTS WHICH CORN ATE
Semantico-Syntactic Abstraction Language (SAL)

(7) a. John kept driving the old car.
    b. John fuhr das alte Auto weiter.
      JOHN DROVE THE OLD CAR ADDITIONALLY

(8) a. John kept the old car.
    b. John behielt das alte Auto.

(9) a. John kept the new car in the garage.
    b. John bewahrte das neue Auto in der Garage auf.
Logos Model Rules

- Source Rules (Patterns, Actions, Constraints)
- Target Rules (Actions, Source Rules)
- SemTable (Semantic Analysis)
Source Rule - Example

**NL Input:** an all-purpose sweater

**SAL Input String:** DET(IDEF; SG) AJ(NAVpred; u) N(COcloth; SG)

**First Rule:**
**Pattern:** DET(u; SG) * N(u; SG)
**Constraint:** None
**Action:**
(i) attaches DET to head N;
(ii) backspaces all but one.

**Second Rule:**
**Pattern:** AJ(u; u) N(u; u)
**Constraint:** None
**Action:** (i) attaches AJ to N;

**Third Rule:**
**Pattern:** N(u; u)
**Constraint:** None
**Action:** (i) → NP; all elements forming the NP are concatenated as NP. NP has SAL Type and Form of head noun, with an indication (in Form field) it is an indefinite NP;
<table>
<thead>
<tr>
<th>Semantic Table (SemTab) rule comment line</th>
<th>Transfer</th>
</tr>
</thead>
</table>
| place(vt) N(advertisement, announcement, ad) | FR: *placer N*  
| PT: *colocar N* |
| place(vt) N(order) | FR: *passer N(commande)*  
| PT: *fazer N(encomenda)* |
| place(vt) N(restriction, constraint) on | FR: *imposer N à*  
| PT: *dar N a* |
| place(vt) N(importance) on | FR: *attacher de l’N à*  
| PT: *dar N a* |
| place(vt) N(pressure) on | FR: *faire N(pression) sur*  
| PT: *exercer N(pressão) sobre* |
| place(vt) N(confidence, trust) in N(AN) | FR: *placer N dans N*  
| PT: *depositar N(confiança) em N* |
Rule Matching

- **RES** – Single pass, macroparsing
- **PAR** – 4 parsing module
  - Simple NP formation, scoping of adjectives, auxiliary verb phrase analysis, analysis of adverbial phrase, resolution of -ing, relabeling of should etc., analysis of ‘as’ and ‘any
  - PP attachment problem, analysis of relative clauses
  - Resolution Verbs and noncontiguous verbs
  - intraclausal tense assignment, interclausal verb tense/mood coordination, pronoun resolution
Pipeline

Macro-parse

(1) - clausal segmentation
    - homograph resolution

R1

(2) - ways of cooking lentils
    - types of cooking utensils

R2

Micro-parse

(3) - bank and appliance store
    - computer and TV store
    - smart boys and girls
    - blue sky and sunshine

P1

(4) - book on war
    - REL clauses

P2

(5) - keep NP
    - keep NP away from NP
    - to NP of NP and NP

P3

(6) - interclausal analysis

P4

S

semantico-syntactic pattern rulebase

input stream
Limitations

- Rule based system – Complexity of SAL Rules
References


Thank you for listening