

Artificial Intelligence Applications In Military - A Survey

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1996

State-of-Art Applications

- Applications On NL
- Applications On Pattern Recognition
- Applications On IFF
- Applications On Neural Networks
- Applications On Other Subjects

Applications On NL

- Eucalyptus
- Discourse for Human-Computer Dialog
- NAUTILUS (Navy AUTomated Intelligent Language Understanding System)
- Extracting Information in a Discourse
- Formatting CASREPS Messages into an Application-Neutral Form

Applications On Pattern Recognition

- Target Extraction in Images
- Machine Perception

Applications On IFF

- An Evaluation Tool to Assess IFF System Performance
- Marine Corps Combat Identification Program
- Data Fusion Algorithms for Target Identification

Applications On Neural Networks

- Clustering Based on the Hopfield Model of Neural Networks
- Multilayer Neural Networks

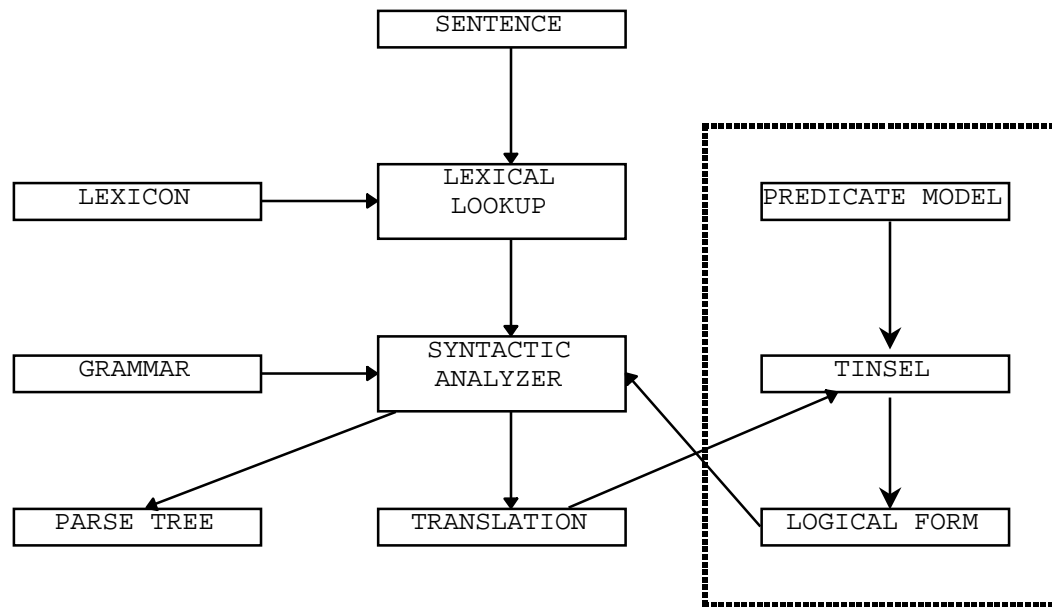
Applications On Other Subjects

- Adaptive Testing of Intelligent Systems
- Control Automation and Task Allocation (CATA)
- Machine Intelligence
- Navy Autonomous Robotic Systems
- ARPA IFOR/WISSARD Project
- MACPlan

TINSEL

(Tandem Interpreter for Selection)

- lexical and thematic semantics



generic NLU system architecture

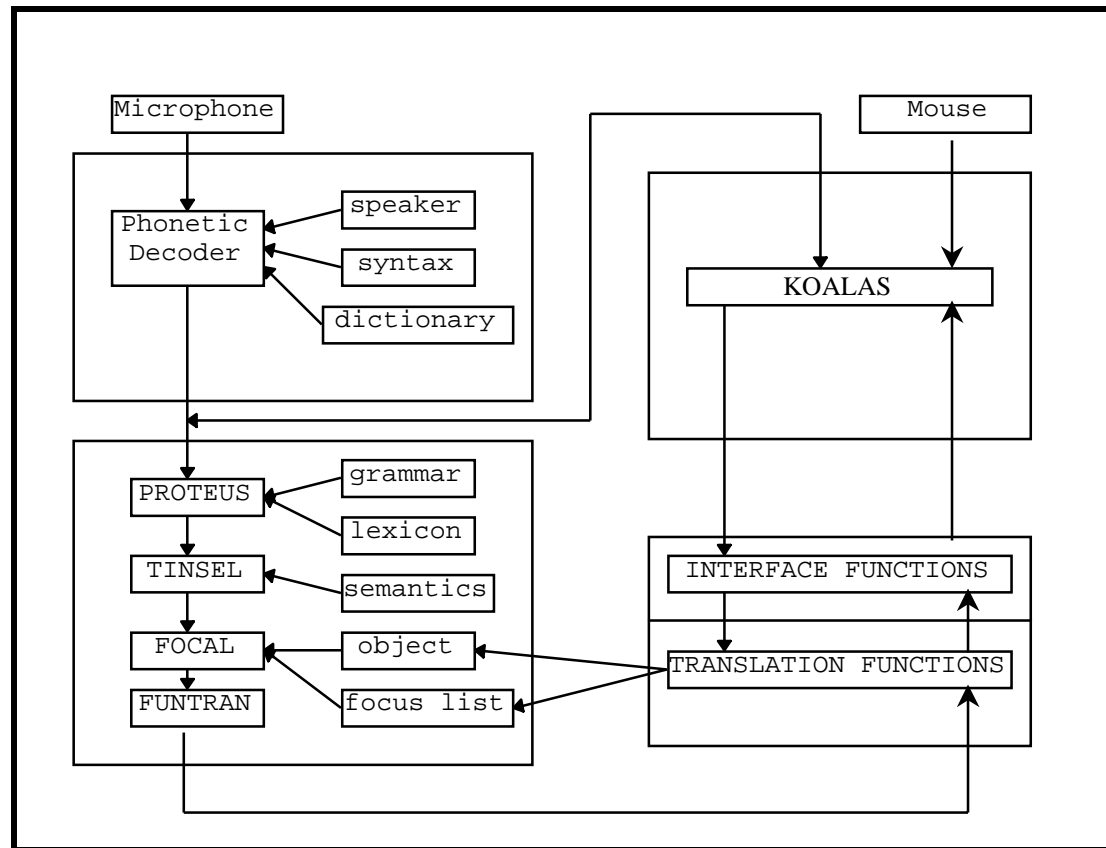
How does TINSEL Interprets ?..

- Top-Down Interpretation
 - Quants Interpretation
 - Wffs Interpretation
- Bottom-Up Interpretation

Comparison With Like-Systems

- Linguistic String Parser
- Question Answering System
- Allen

Architecture of Eucalyptus



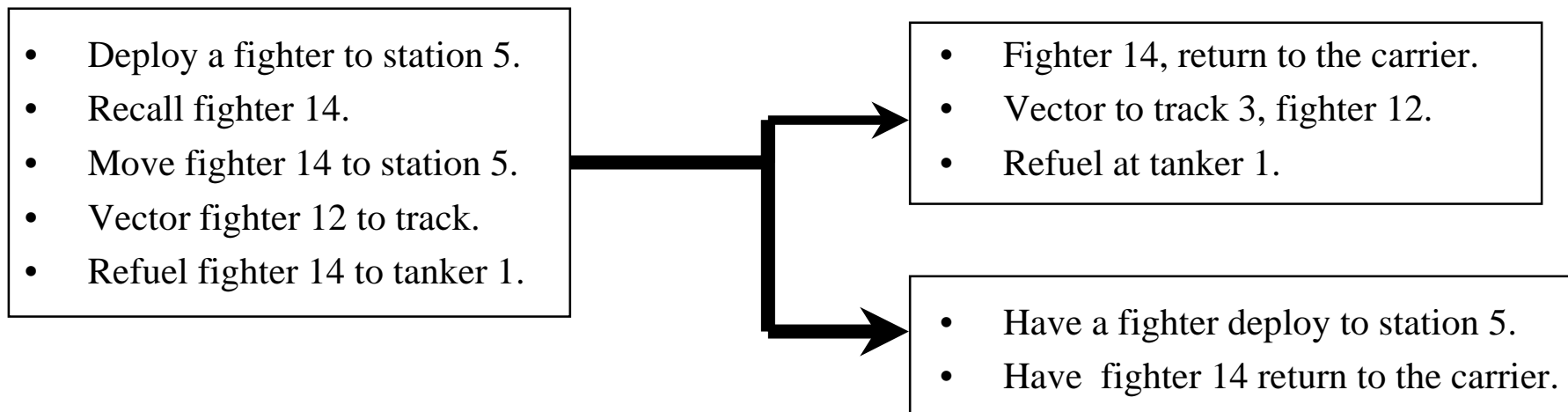
Eucalyptus

Working Assumptions

- Commercial Speech Recognition
- Natural Language Only
- Input Only
- GUI Unchanged
- No Graphical MetaLanguage

NL Examples

- Move: order a deployed aircraft to a new assignment station.
 - Deploy : order an aircraft from the carrier to an assignment station.
 - Vector : order a fighter out to a hypothetical threat's coordinates.
 - Refuel : order an aircraft to a tanker to for refueling.
 - Recall : order an aircraft back to the carrier.
-



Handling NL Problems

- Anaphora

Are any fighters vectoring to threats ?

Yes, F14 1.

Which one is he vectoring to ?

Badger 5.

Are there any fighters still on the carrier ?

Yes, F14 18 and F14 19

Deploy one of them and vector him out to that threat.

- Ellipses

Increase the simulation speed.

Again

Which F14s are moving to station 1 ?.

Which UAVs are ?.

Is fighter 1 moving to station 1 ?.

Is fighter 2 ?.

Is fighter 1 moving to station 1 ?.

Recall a UAV that is.

Are any F14s moving to station 1 ?.

Any UAVs ?.

What about station 5 ?.

I meant station 4.

Is fighter 4 moving to tanker ?.

I said fighter 4.

The tanker.

Implementation

- NL processor is nearly 6860 lines of Common Lisp code.
- Eucalyptus translator module is 2940 lines of Lisp and 2480 lines of C code.
- KOALAS source is nearly 16150 lines of C code.
- Database files total about 5750 lines of text.
- KOALAS execution needs 3.1 MB runtime memory.
- Lisp needs 6 MB runtime memory.
- Eucalyptus code and data needs about 4.5 MB runtime memory.

Data Processing Examples

SSI Phonetic Decoder Output

are all the f fourteen's moving to a station that fighter 1 is holding

PROTEUS intermediate syntactic representation

```
(REQUEST PRESENT PROG MOVE
  (ALL N1 F14 PLURAL
    (TO (SOME N2 STATION SINGULAR
      (PRESENT PROG HOLD
        (NULL-DET N3 FIGHTER SINGULAR(IDNUM 1))
        VAR))))))
```

TINSEL semantic interpretation

```
(REQUEST PRESENT PROG V1 (:CLASS P-MOVE)
  (:PATIENT (ALL N1 (:CLASS P-F14 PLURAL)))
  (:TO-LOC (SOME N2 (:CLASS P-STATION) SINGULAR
    (PRESENT PROG V2 (:CLASS P-HOLD)
      (:PATIENT (NULL-DET N3 (:CLASS P-FIGHTER)
        SINGULAR (:ID 1))))
      (:AT-LOC N2))))))
```

FOCAL alternate focus list

```
((N1 SINGULAR P-FIGHTER : PATIENT(FRIENDLY-1 . . .
FRIENDLY-9))
(N2 SINGULAR P-STATION :TO-LOC (STATION-2))
(N3 SINGULAR P-F14 :PATIENT (FRIENDLY-1)))
```

Data Processing Examples (continued)

FUNTRAN quantified expression

```
(FORALL X1 (SETOF N1 P-F14)
  (EXISTS X2 (SETOF N2 P-STATION
    (EXISTS! X3 (SETOF N3 P-FIGHTER (:ID 1))
      (P-HOLD : PATIENT X3 :AT-LOC N2))))
  (P-MOVE :PATIENT X1 :TO-LOC X2)))
```

Quantified expression after performative insertion

```
(TELLIFALL (SETOF X1 (SETOF N1 P-F14)
  (EXISTS X2 (SETOF N2 P-STATION
    (EXISTS! X3 (SETOF N3 P-FIGHTER (:ID 1))
      (P-HOLD : PATIENT X3 :AT-LOC N2))))
  (P-MOVE :PATIENT X1 :TO-LOC X2)))
```