

# Robust Information Extraction in a Speech Translation System

Norbert Reithinger

Deutsches Forschungszentrum für Künstliche Intelligenz GmbH

Stuhlsatzenhausweg 3

D-66123 Saarbrücken

Germany

e-mail: `norbert.reithinger@dfki.de`



# Overview

- Role of Robust Information Extraction
- Content Representation
- Extraction with Cascaded Automata
- Generation
- Current State



# Verb*mobil*

- speaker independent speech-to-speech translation system
- languages: German, English, Japanese
- domains: appointment scheduling, travel planning, hotel reservation
- hybrid approach with distinct complementary processing tracks
  1. deep translation
  2. statistical translation
  3. example-based translation
  4. dialogue act based translation



# Role of Robust Information Extraction

- recognition errors and spontaneous speech phenomena
- “deep” analysis sometimes difficult
- abstract representation of the main contents of an utterance needed
- used in *VerbMobil* for
  - tracking the dialogue topics in the dialogue memory
  - dialogue summary
  - dialogue act based translation
- provided by information extraction



# Content Representation

- important information: times and dates, travel directions, trains, hotel reservation and related topics
- definition of two representation languages: TEL for time expressions and DRL for travel related information (together with partners at TU Berlin)
- examples:

*four o'clock PM* → [from: [tod:4:0, pod:pm]]

*we take the train at seven to Berlin*

→ [suggest, traveling, has\_move: [move,  
has\_date: [date, tempex='tempex(i1, [from:tod:7:0])'],  
has\_dest\_location: [geo\_location, has\_name='berlin'],  
has\_transportation: [rail]]]

# Cascaded Automata

- needed: robust, fast extraction from speech recognition results
- solution: cascaded automata
- wanted: easy integration of knowledge from semantic knowledge sources in *Verbmobil* to reduce redundancies
- graphical user interface for development
- implemented in C++ and Tcl/TK





# Extracting Information (1)

- TEL and DRL analyzed independently
- time expressions: restricted vocabulary and (mostly) grouped locally
  - analyse special names like holidays
  - find clock times, months, and years
  - build up complex structures like:
    - the twenty ninth thirtieth and thirty first*
    - [from:set([dom:29,dom:30,dom:31])]
- travel and hotel information are more complicated



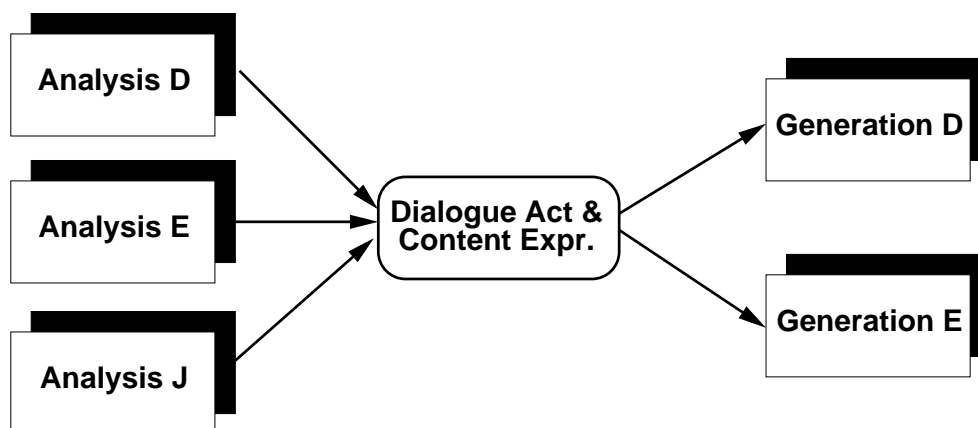
## Extracting Information (2)

- a click-and-draw GUI isn't that useful when entering large amounts of information
- semantic databases in  $\sqrt{\text{verb}}_{\text{mobil}}$  contain class information like `move` verbs and nouns in all  $\sqrt{\text{verb}}_{\text{mobil}}$  languages
- automata are defined as text-files
- scripts automatically build up definitions from these databases, e.g.:
  - S0 S1 `intern(move_indicator)`
  - travel S1 S2 -
  - reach S1 S2 -
  - move S1 S2 -
  - ...
- 186 automata for German, 167 for English, and 127 for Japanese (mainly TRL) at the time of writing



# Generating from Content Expressions (1)

- content expressions are used as sort of “interlingua” structures for dialogue act based translation:



- dialogue acts (ACCEPT, REJECT, ...) are computed with language models (Eurospeech 97)
- sentence pattern selected by dialogue act
- content information is spliced into the patterns

# Generating from Content Expressions (2)

- cascaded automata translate TEL and DRL expressions into the target language
- problems with inflecting languages like German: use prepositions with known case
- example:

*ja dann treffen wir uns doch am Mittwoch am Bahnhof*

→ [ACCEPT, scheduling, has\_appointment: [appointment, has\_date: [date, tempex='tempex(i58, [from:dow:wed])'], has\_location: [nongeo\_location, has\_name='bahnhof']]]

→ *at the station on Wednesday sounds good!*

- at the time of writing, 229 automata are used to generate German and 195 to generate English

# Current State

- robust and fast processing
- good coverage
- translation success comparable to the other translation tracks in *VerbMobil*
- recent additions
  - Japanese generation added
  - integration of external knowledge sources enhanced

