The Development of Estonian Natural Language Dialogue Systems: A Case Study

Margus Treumuth

Dialogue system

- **A dialogue system is** a computational application by means of which a human interacts with a system using natural language.
- Natural and flexible access to digital information
- Decrease of routine work (online services, timetables, FAQ)

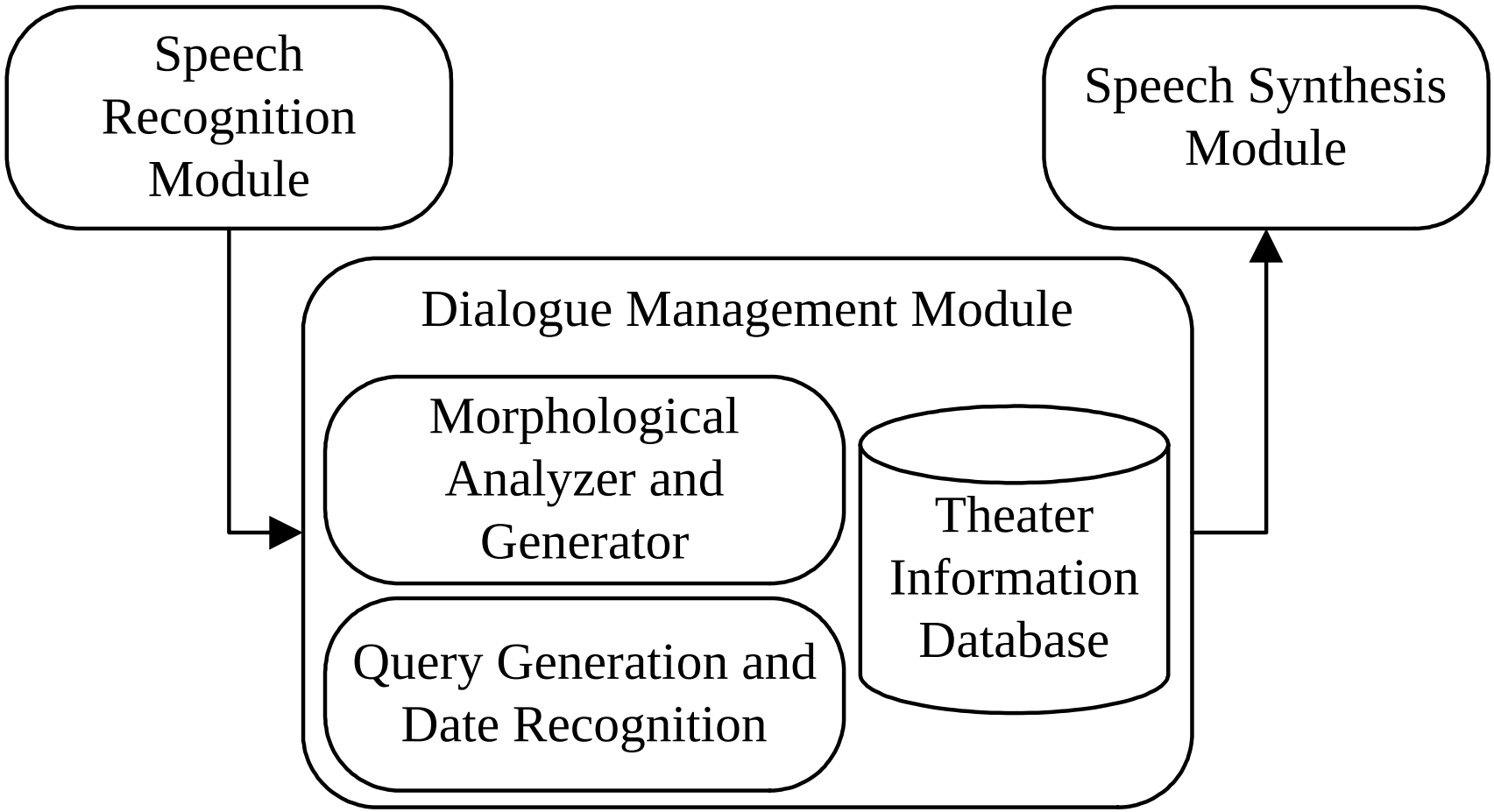
Goal of the project

- Build a dialogue system that operates in a constrained linguistic domain – theater information.
- The system should accept either typewritten or spoken language.
- The system should produce either typewritten or spoken output.
- The language used by the dialogue system is Estonian.

Project members and tasks

- Joint research project of the University of Tartu and the Tallinn University of Technology
- Dialogue management module – Tartu
- Speech recognition – Tallinn
  - Tanel Alumäe
  - Einar Meister
- Speech synthesis – Tallinn
  - Einar Meister

Dialogue system components



Speech recognition

- segments the input stream into utterances
- produces a recognition hypothesis for each segment
- triggers barge-in, if it detects speech that continues for a configurable amount of time
- barge-in sends a signal to the speech synthesis module to stop any speech output

Dialogue manager - Tasks

- Initiates, maintains and records interaction
- Reaction to input (ask, inform, confirm, correct)
- Maintenance of dialogue history and context
- Interfaces to other system components

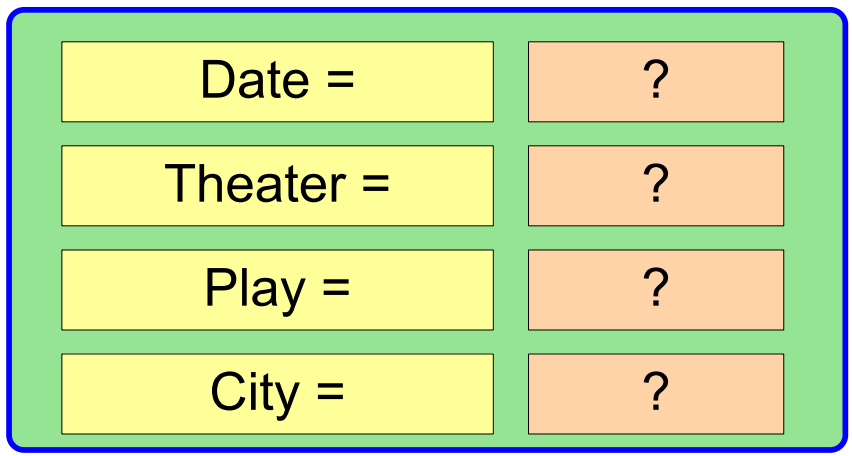
Dialogue manager - Components

- Morphological analysis
  - gives us base forms
- Date recognition
  - „next Sunday” gives us 14.05.2006
- Play, Theater, City recognition
- Query Generation
  - fills the fields in a frame to send a query to the database
- Database
- Morphological synthesis
- Answer generation

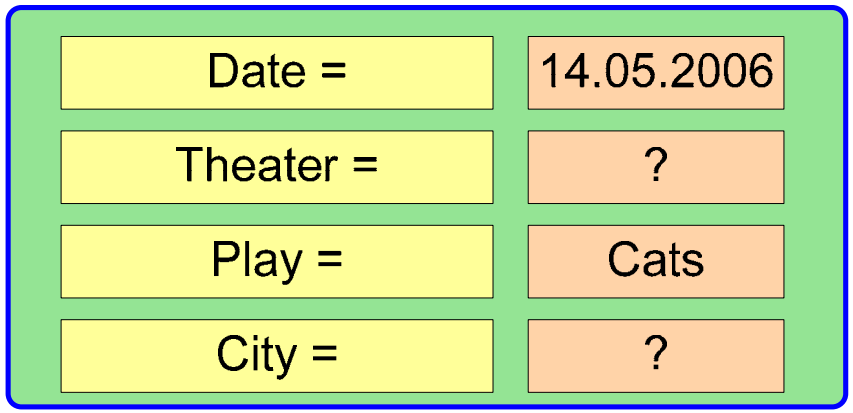
Query generation

Spoken or typewritten input (in Estonian):

„I’d like to see Cats on next Sunday.”



Query generation




```
SELECT   t.theater_name,
         p.play_date,
         p.play_time,
         p.play_title
    FROM plays p, theaters t
   WHERE t.id = p.theater_id
     AND p.play_date >= CURDATE()
     AND p.play_date = STR_TO_DATE('14.05.2006', '%d.%m.%Y')
     AND p.play_title = 'Cats'
ORDER BY p.play_date
```

Speech synthesis

- two modalities
  - in text form
  - via speech output
- linguistic analysis of the input text
- orthographic text is converted into phonemic representation
- prosody model calculates the phoneme durations and the contour of fundamental frequency
- MBROLA model (Dutoit, et al., 1993)

The near future

- to produce better speech output, we should send some specific tags to the speech synthesis that include information about dialogue structure
- we should expand the knowledge base and probably switch to AIML (artificial intelligence markup language)