



UNIVERSITÀ DEGLI STUDI DI NAPOLI  
FEDERICO II

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Marco Grazioso

# Computational Linguistics techniques for the development of ChatBot architectures for commercial applications

Tutor: Prof. Francesco Cutugno

co-Tutor: PhD. Valentina Russo

Cycle:XXXVI

Year: II

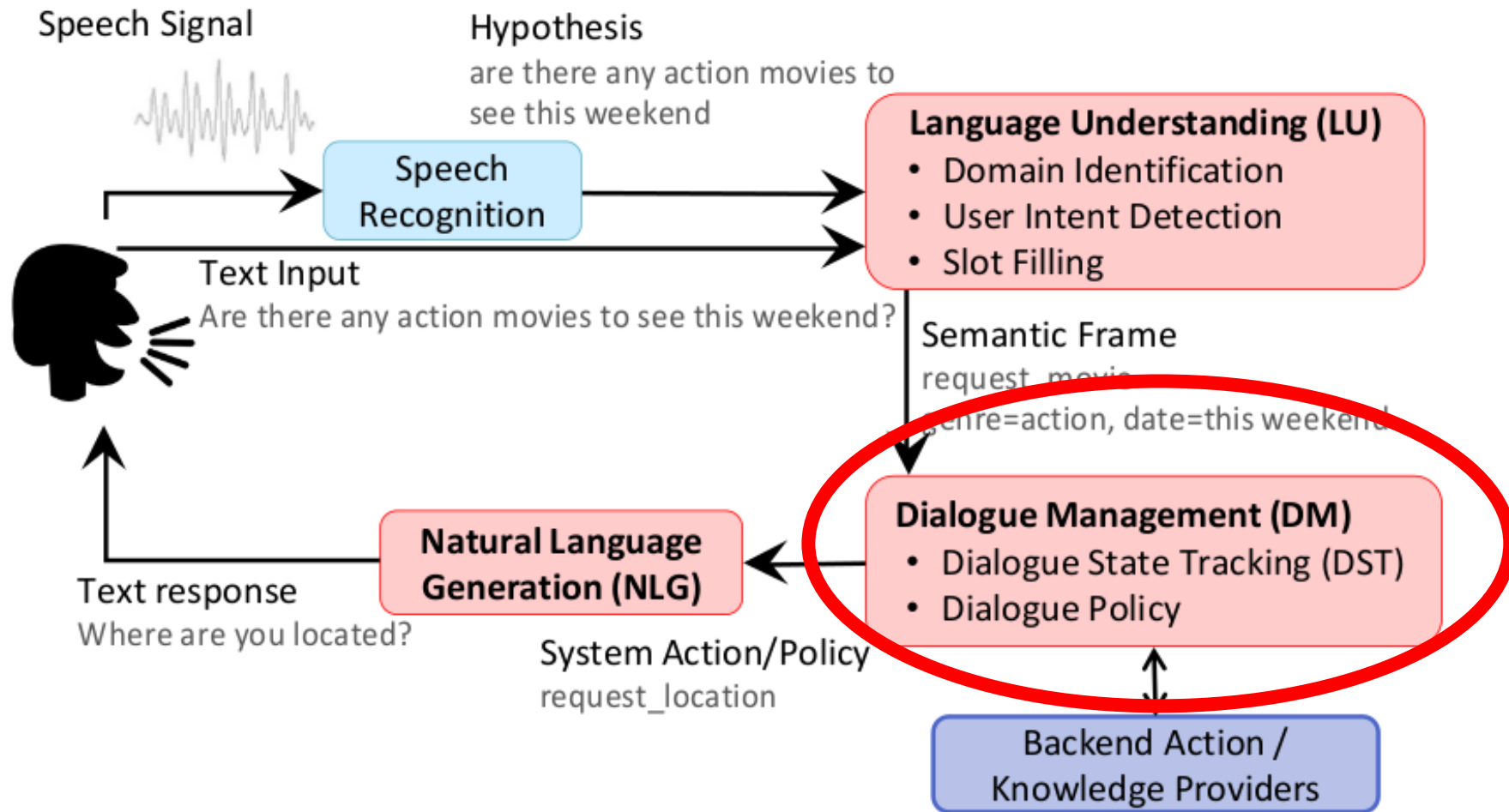
# My background

- MSc degree in Computer Science with a thesis in Human-Computer Interaction
- URBAN/ECO Research Center
- PhD started 1 November 2020
- Scholarship funded by Logogramma s.r.l.

# Research field of interest

- **Task-Oriented Dialogue Systems (TODS)** interact with users in natural language to help them in achieving their goals.
- TODSs involve several processes :
  - Natural Language Understanding
    - Intent recognition
    - Named entity recognition
    - Slot-filling
  - Dialogue Management
    - **Dialogue state tracking**
    - Dialogue policy
  - Natural Language Generation

# Dialogue system

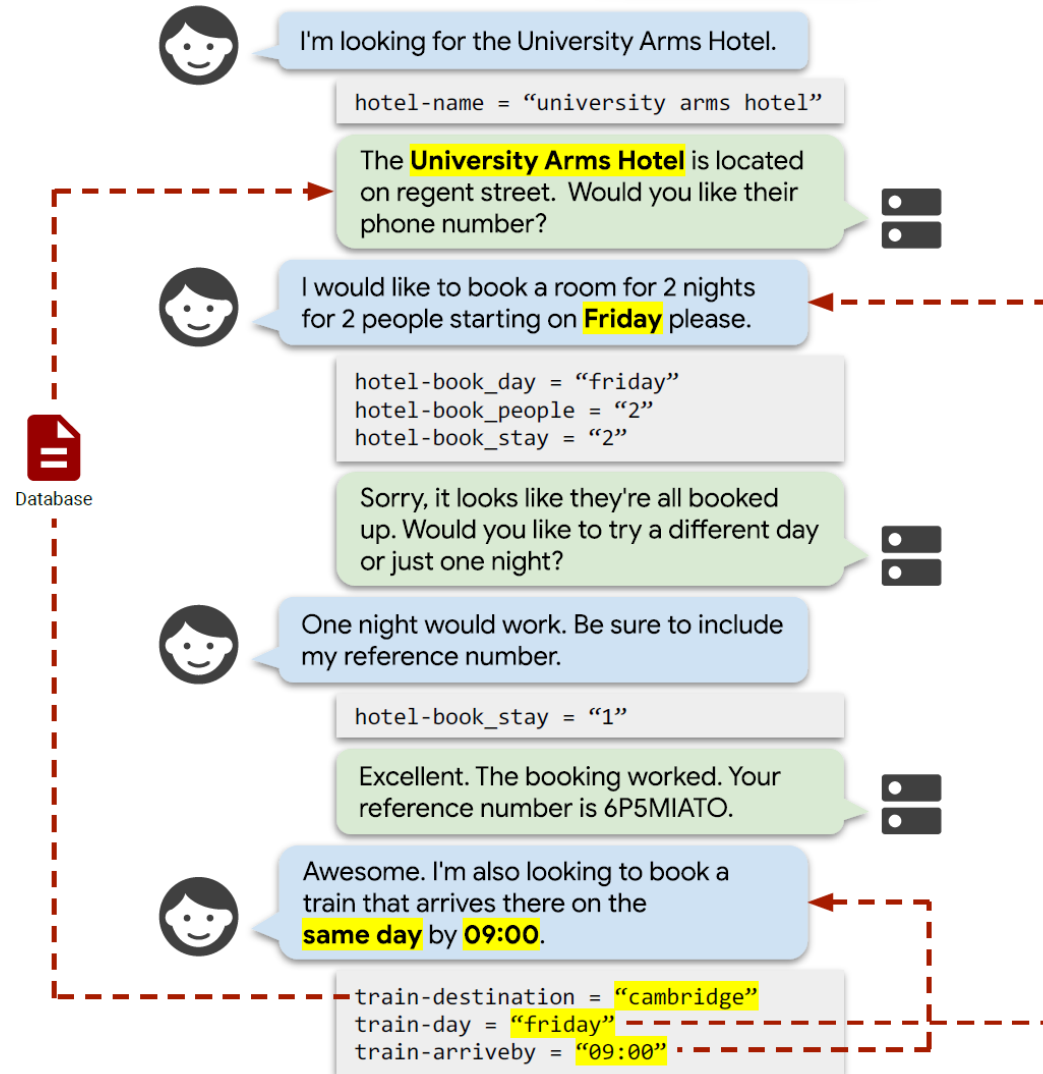


# Summary of study activities

- Ad hoc PhD courses / schools
  - Lectures on Computational Linguistics 2022
  - Academic entrepreneurship
- Courses borrowed from MSc curricula
  - Neural networks and deep learning
- Conferences / events attended
  - AIxIA 2021, 20th International Conference, Italian Association for Artificial Intelligence
  - ACL 2022, 60th international meeting

# Contextual and Conversational issues

- A. Conversational:** the information must be retrieved from the previous exchanges.
- B. Contextual:**
- Situational:** the slot value in the dialog state depends on the circumstances of the dialogue, e.g., its date or location, that are not explicitly mentioned.
  - Knowledge about the user:** the dialogue state depends on some knowledge about the user (e.g., dietary restrictions or movie preferences).
  - External knowledge:** the dialogue state depends on some world knowledge and requires, e.g., a query from an external database.

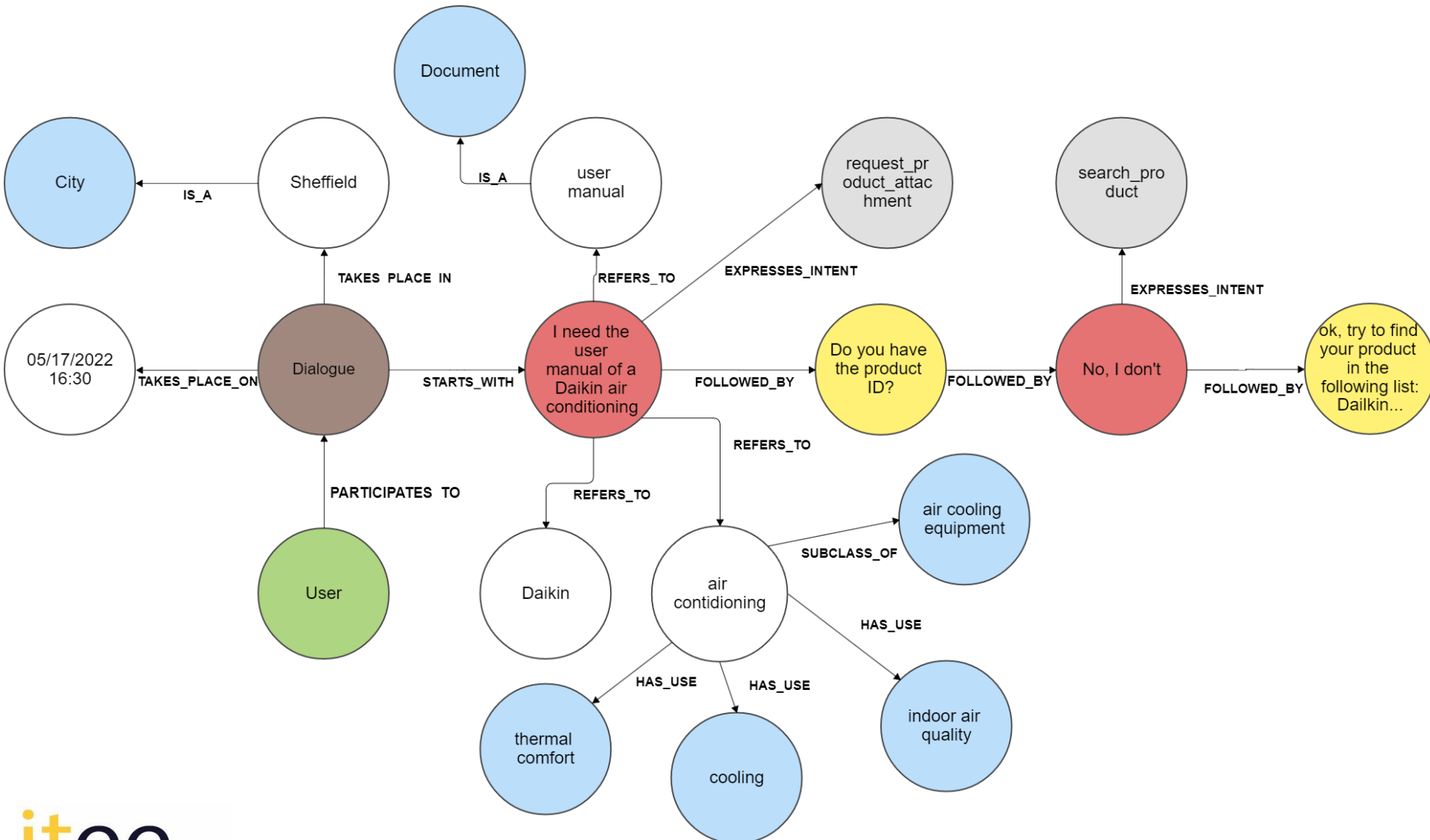


# Research activity: Overview

- Problem
  - *Current DST datasets lack contextual and conversational examples (Jakobovits et al. 2022).*
  - *Consequently, state-of-the-art trackers can't manage these issues.*
- Objective
  - *Define a dialogue state representation which can manage contextual and conversational issues.*
- Methodology
  - *Definition of a graph-based representation (nodes, relationships and properties)*
  - *Definition of graph algorithms to retrieve information from previous interactions, knowledge about both user and world.*
  - *Prototype validation through different measures: Joint Goal Accuracy, user satisfaction questionnaire and others.*

Jakobovits, A. S., Piccinno, F., & Altun, Y. (2022). What Did You Say? Task-Oriented Dialog Datasets Are Not Conversational!?. *arXiv preprint arXiv:2203.03431*.

# Contextual and Conversational issues





# Products

[P1]	Russo, V., Mancini, A., Grazioso, M., & Di Bratto, M. (2022). Graph-based representations of clarification strategies supporting automatic dialogue management. IJCoL. Italian Journal of Computational Linguistics, 8(8-1).
[P2]	Developed a ChatBot prototype, presented at the SMAU fairs, Milan 11th to 12th October 2022
[P3]	D'ASARO, F. A., Raggioli, L., Malek, S., Grazioso, M., & Rossi, S. (2022). An Application of a Runtime Epistemic Probabilistic Event Calculus to Decision-making in e-Health Systems. Theory and Practice of Logic Programming, 1-24.
[P4]	Origlia, A., Grazioso, M., Chiacchio, M. L., & Cutugno, F. (2022). 3D Avatars and Semantic Models Annotations for Introductory Cultural Heritage Presentations. In Proceedings of the 2022 AVI-CH Workshop on Advanced Visual Interfaces for Cultural Heritage. CEUR-WS. org.

# What's next

- Finalise the implementation of a dialogue state tracking module to be applied and tested in the already developed chatbot prototype.
- Stay in Edinburgh for a research period and apply my research in the field of human-robot interaction.
- Collect data in both domains and validate the research assumptions.