Self-adaptation and auto-configuration of probabilistic graphical models for Smart Homes and Ambient Assisted Living applications

Erinc Merdivan

AIT Austrian Institute of Technology GmbH

Sten Hanke, Johannes Kropf

Matthieu Geist

24.10.2017

ESR Background

- Bsc. Electronics and Msc. Computer Science
  (Sabanci Uni.,Istanbul,Turkey)

- Google Technical Analyst (Dublin, Ireland)
  - Technical analysis on google accounts

- IBM Watson Core Algorithms Developer
  - NLP, Machine learning algorithms for Watson Core

EMBODIED CONVERSATIONAL AGENTS
FROM LAB TO REAL LIFE SETTINGS

Tanya, Northeastern University

Carmen ,Stanford University

Tanya , Northeastern University

Various target applications:

Therapist
Assistant   Tutor

Coach   Companion

Useful and successful ECAs should be capable of interacting with naive, uninformed humans in everyday situations!
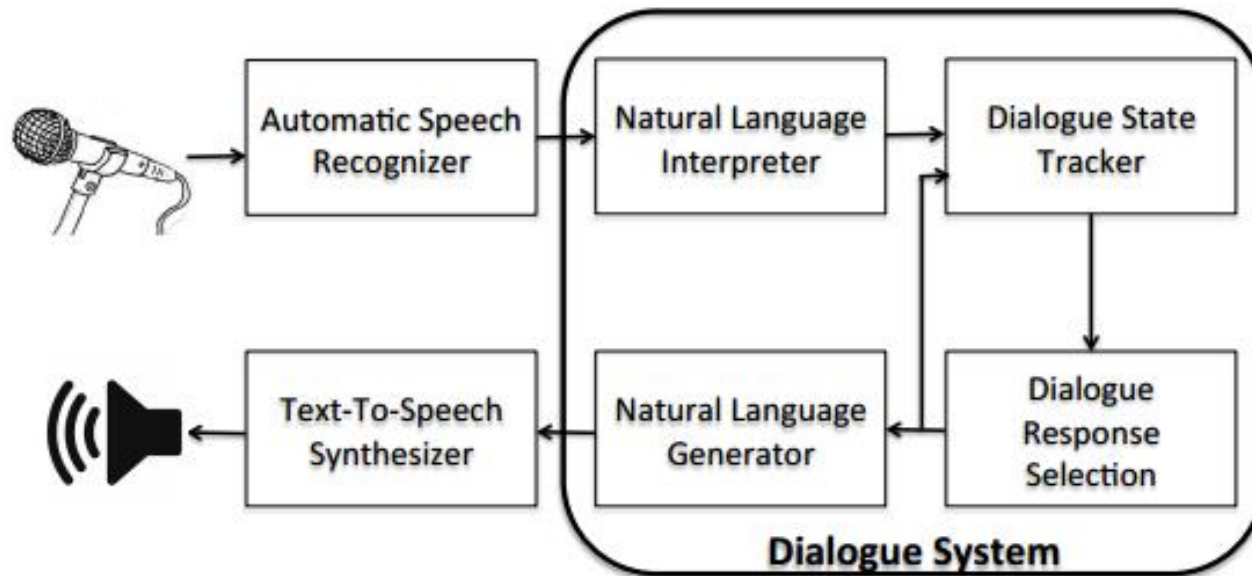
A C. King, T. W. Bickmore, M. I. Campero, L. A. Pruitt, and J. L. Yin.2013. Employing virtual advisors in preventive care for underserved communities: Results from the COMPASS study
 Bickmore, T.W. and Picard, R.W. 2005. Establishing and Maintaining   Long-Term Human-Computer Relationships.

State-of-art Dialogue Systems

- Rule Based
- All scenarios are hand-crafted (XML structure)
- Very little capability for natural language
- Not personalised
- Problems understanding the spoken dialogue
- No evaluation of dialogue replies in order to train intelligent systems
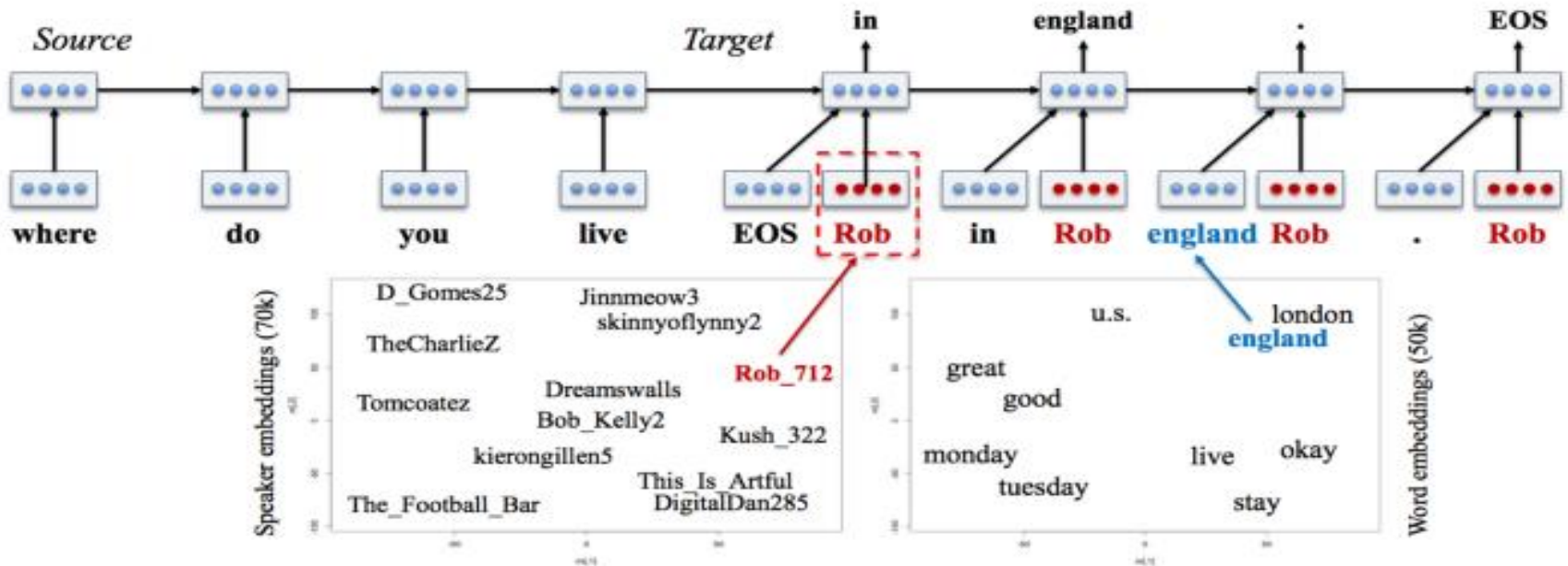
Complete Dialogue System

XML Based Dialogue

ML Based Systems

Research Project Objectives

- Qualitative study of human dialogue
- Observing and understanding how humans communicate with each other
- Investigation of existing dialogue interaction of older people with humans and also interfaces
- Improving existing communication of interfaces with older people in AAL and SH

Research Project Objectives

- Intelligent models for SH and AAL applications
  - Dialog Management Systems
  - Dialog Manager (DM) with Natural Language Understanding
  - Machine learning based DM instead of rule based

Research Methodologies

1. Literature Search on existing dialogue Systems in SH and AAL
2. Investigate methods on flexible, adaptive and personalized dialogues
3. Concrete use case and scenario definition (activity booking)
4. Implement this scenario in AIT systems and/or Acrossing avatar
5. User study to evaluate the dialogue replies
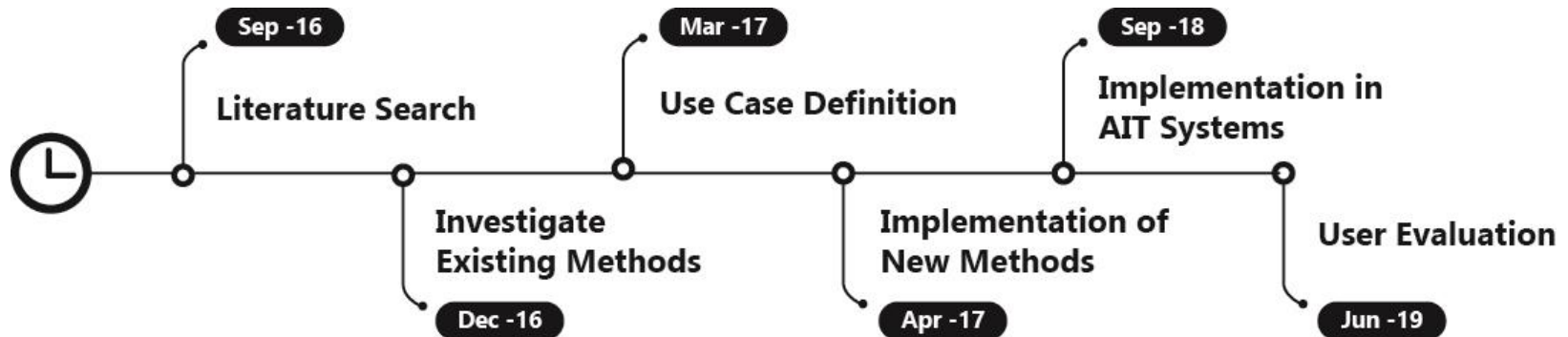
Research Achievements

- Improved autoencoders in order to discriminate unknown distributions

- Used energy as a distance between classes

- Designed an intelligent network which can provide meaningful score for dialogue scores

APP1, APP2 and SO4

- **APP1 → virtual avatar** with spoken dialogue capability
    - Virtual Avatar
    - Sound and Speech Processing
    - Dialogue Manager

- **APP2 →** monitor user exercise with egocentric camera, **recognize the activity**, asses air quality and give feedback to user about how well exercise is performed
    - Air quality measurement
    - Activity recognition
    - Ego-Centric Vision
    - Feedback with dialogue

- **SO4 →** common **data platform** which is privacy enabled with **secure dialogue** management and different user privatization techniques
    - Privacy Model communication
    - Common data framework
    - Privacy enabled

Research Achievements

■ Published Papers

- Singh, D., Merdivan, E., Psychoula, I., Kropf, J., Hanke, S., Geist, M., & Holzinger, A. (2017, August). Human Activity Recognition Using Recurrent Neural Networks. In International Cross-Domain Conference for Machine Learning and Knowledge Extraction (pp. 267-274). Springer.

- E. Merdivan, M. Loghmani, M. Geist. Reconstruct and Crush Network. Neural Information Processing Systems (NIPS) 2017

- Deepika Singh, Erinc Merdivan, Sten Hanke, Johannes Kropf, Matthieu Geist, and Andreas Holzinger. "Convolutional and Recurrent Neural Networks for Activity Recognition in Smart Environment". To be published in Springer Lecture Notes in Artificial Intelligence LNAI 10344

ACROSSING Training Experiences

- Understand the current situation of aging population and their care needs with social and economical impacts on EU
- Scientific writing from real world examples
- Experience on sensors and applications
- Get an insight on how AI and smart systems are used in industry level health care application
- Discussed with ESR 13 about spoken dialogue systems and arranged a secondment in order to work on it

  - **Thessasloniki Training Event**

  - **Passau Training Event**

  - **DMU UK Training Event**

Outside Training Experiences

- ICPR 2016 December Mexico
  - First international conference attendance
  - Attended to inspirational talks and learned from other people work
- CentraleSupelec 2017 March France
  - Worked with PhD supervisor
  - Developed a deep network later turned into a NIPS paper
- LxMLS 2017 July Portugal
  - Meet with contacts all over world who are working on NLP and ML
  - Attended very interesting talks and state-of-art systems on AI and NLP
- NIPS 2017 December USA
  - To be attended

Impact on Future Career

- Publish papers
- Create contacts in among ESRs, AIT employees and PhDs outside consortium
- Acquired knowledge on state-of-art systems
- Access to real world applications in AIT projects and ability modify them with new ideas
- Many AAL projects currently running in AIT which helps to experience different deployed systems
- AIT's excellent connection in Austria and Europe
- Real users and their requirements

Thank you!
Any Questions?

www.acrossing-itn.eu

@acrossing_itn

10/11/2017

18