

Enhancing Companion Dialogue with Episodic Memory

Gregor Sieber, Brigitte Krenn {gregor.sieber, brigitte.krenn}@ofai.at

Overview

Artificial Companions are computer systems that interact and collaborate with the user over a longer period of time, employing human-like communication. They have memory and are able to learn from the interaction with their users. Due to their long-term relationships with users and their ability to communicate in a human-like fashion they have social effects on the user.

We aim at improving the dialogue capabilities of companions by endowing them with episodic memory (EM) and integrating it with action selection and dialogue control. Our research builds upon the platform and companions developed in the RASCALLI project [1][2], but can be easily transferred to other applications.

Goals

The goal of equipping companions with EM is to achieve more coherent, believable behaviour based on experiences:

- support action selection based on similarity to past experiences
- explain actions of companions (mistakes / offline tasks)
- provide more interesting dialogue by being able to make statements about:
 - users' current and past preferences, and their relation to the current situation
 - patterns, similarities and dissimilarities between current and past interactions
- employ user preferences stored in the EM to:
 - improve answer retrieval from knowledge bases
 - proactively present interesting information to the user

Method

We propose an episodic memory component integrated with action selection and dialogue control. Episodic memory is part of long-term memory. It stores personal experiences in association with their time, mindset, feelings, and place [3].

Models of EM have been used successfully in robotics [4], artificial life agents [5], interactive storytelling [6], and non-player characters [7].

While our use of episodic memory is tightly integrated with the agent's dialogue control, the EM is still task-independent and can be used by other components.

References:

- [1] B. Krenn, M. Skowron, G. Sieber, E. Gstrein, J. Irran. Adaptive Mind Agent. In IVA '09: Proceedings of the 8th international conference on Intelligent Virtual Agents, pages 519-520, 2009
- [2] B. Krenn, C. Schollum. The RASCALLI Platform for a Flexible and Distributed Development of Virtual Systems Augmented with Cognition. In Proceedings of the International Conference on Cognitive Systems, pages 91-96, 2008
- [3] E. Tulving. Episodic Memory: From Mind to Brain. Annual Review of Psychology, Vol. 53, pages 1-25, 2002
- [4] W. Dodd and R. Gutierrez. The role of episodic memory and emotion in a cognitive robot. In IEEE International Workshop on Robots and Human Interactive Communication, pages 692-697, 2005
- [5] A. Nuxoll. Enhancing Intelligent Agents with Episodic Memory. PhD thesis, Univ. of Michigan, Ann Arbor, 2007
- [6] W. C. Ho and K. Dautenhahn. Towards a narrative mind: The creation of coherent life stories for believable virtual agents. In IVA '08: Proceedings of the 8th International Conference on Intelligent Virtual Agents, pages 59-72, 2008
- [7] C. Brom and J. Lukavsky. Towards Virtual Characters with a Full Episodic Memory II: The Episodic Memory Strikes Back. In Proceedings of Empathic Agents, AAMAS workshop, pages 1-9, 2009

Acknowledgements:

The work presented is supported by the Austrian Ministry for Transport, Innovation and Technology (BMVIT) under the programme "FEMtech Women in Research and Technology" grant nr. 821855, project C4U. The Austrian Research Institute for Artificial Intelligence (OFAI) is supported by the Austrian ministries BMVIT and BMWF.

Realisation

Environment

The RASCALLI system provides a platform for developing companions including an ECA and a web interface for browsing music collections. The domain of our prototype agent is music and gossip about artists. Part of the agent's long term memory is a knowledge base containing relevant information. Dialogue control is a combined action selection and dialogue management unit. The short term memory contains details about the current situation.

Triggers for Episode Encoding

- user input through ECA interface
- user input through web interface
- daily snapshot of user's preferred music
- agent actions (answer retrieval, message to user, ...)

Episode Storage

- episodes contain all data describing the situation at the time of encoding
- stored as RDF graphs associated with temporal information

Episode Retrieval

- deliberate: searching for patterns or regularities in memory for interesting dialogue
- spontaneous: past interactions resemble current situation
- queries for parts of episodes possible

Dialogue Control

- mapping of user questions to queries
- answer retrieval from knowledge base and EM
- search EM for patterns exploitable for dialogue
- send utterance to user based on output of pattern search or answer retrieval

Note: the realisation presented here is work in progress.

