

Forgetting in working and in episodic memory

Remembering what happened is one key element of intelligence. We as humans make massive use of multi-modal experiences when being faced with new scenarios or when deciding how to behave in a certain situation. However, the counterpart of creating new memories, forgetting, can also be seen as one of the most notable characteristics of cognitive agents [1].



Figure 1: The humanoid robot Armar-6 removing memories from his mind

For convenience, memory in artificial cognitive agents is often assumed to be persistent. Unfortunately, forgetting is not well understood even in cognitive psychology research [2], but we can assume that this simplification hides important aspects of cognition, such as how a cognitive system can alleviate the forgetting process and thus strengthen important memories.

Recently, we implemented a new multi-modal episodic memory architecture for our robot software framework ArmarX including all aspects from sensory memory to declarative and nondeclarative memory. Sub-symbolic modalities are encoded to a latent space representation using autoencoders in order to minimize the used amount of space. The latent representation allows recall, reconstruction and prediction.

At the current stage of development, we follow the above-mentioned simplification of a persistent memory. However, recording a very long sequence – or even a lifetime – of experiences would include a lot of redundant frames.

In this project, you will improve our existing ArmarX memory structure with mechanisms filtering the data-stream from working memory to long-term memory and with a garbage collection, removing unused or unnecessary memories from the robot's long-term memory using algorithms such as Jost's law or entropy-based approaches [3].

We encourage the student(s) to publish the results of this work on a highly prestigious international conference for robotics (last years participant even won the best-interactive-paper award). Knowledge in C++ is required for this work.

[1] D. Vernon, *Cognitive Systems - A Primer*, 2014

[2] J. T. Wixted, *The psychology and neuroscience of forgetting*, 2004

[3] A. Nuxoll et. al, *Comparing forgetting algorithms for artificial episodic memory systems*, 2010

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