Towards Memorizing by Adjectives

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Abstract

Reacting is influenced often by mentally recognizing objects in which cases the associated features of these objects are recalled. This could be a lengthy process. In humans distinct features are associated with objects as adjectives. In this paper we represent a preliminary research on enabling robots or software agents to use this fact.

Introduction

It is important for robots to recognize objects fast enough to interact with their environment putting pressure on the amount of information a robot can handle. Consequently, many robotics, knowledge representation and AI planning [1, 2] researchers focused on simulating human memory and reasoning system. Human memory is organized in many different ways depending on importance, time, emotions, relevance to other subjects and so on [3]. In this paper some of the psychology research advances is deployed in proposing a memory hierarchy that allows anchoring concepts and objects. By anchoring a given object to a concept or several concepts, some default features of that object can be retrieved fast to improve the robots performance in their environment. As an example, consider a robot R is navigating its way within a room. R sees a chair, by anchoring the chair to some related concepts such as solid, and movable objects; R can determine that the chair is solid in terms of space occupation and movable. Knowing these facts about the chair would improve the planning process of R since the shape of the chair, for example, is of a little relevance. This paper reports on the preliminary stages of this work.

Background and Motivation

To explain what memorizing by adjectives means let us take for example a name, such as Jackie. Let us assume that Jackie is a subject of conversation between two agents, which may be in the following form:

Agent A: do you remember Jackie?
Agent B: is she the *tall* girl from *11th grade.*
Agent A: no. She is my *cousin* Jackie the *tiny.*

Remembering Jackie is associated with features of Jackie, e.g. tall, tiny, 11th grade, cousin and so on, in addition to the concept of human female gender and the features associated with that concept. In general there are two main processes associated with memory: organization and retrieval. Numerous works have been done on memory

organization both in Artificial Intelligence (AI) [1, 2, 4-6]] and psychology [7]. Most of AI techniques that are developed to explain the retrieval process are organization-specific. For example, search algorithms [8] are used with databases and tree based organizational format such as frames [9]. Problem solvers or automated proof systems [10, 11] are used with formal representation of knowledge.

Proposed Memory Hierarchy

From psychology literature, there are different levels of memory, which should be taken in consideration, such as short and long memory [7, 12]. This leads to the proposal of surface, archive, and mental flag memory. Time, emotions and relevance determine at which level of memory information is maintained. To clarify the meaning of these levels within the proposed memory hierarchy (figure 1) we provide our own definitions.

Definition 1 Short memory is a mental organization of mind in which current objects' information is maintained with limitation of time and/or relevance.

Definition 2 Long memory is a mental organization of mind in which objects' information is maintained with relation to concepts, emotions and/or relevance.

Definition 3 Surface memory is a part of long memory in which objects' information has priority in the retrieval process because of time, emotions and/or relevance.

Definition 4 Archiving process is a re-organization of the long memory in which objects' information is re-categorized and either maintained in relation to a concept with a low priority or deleted.
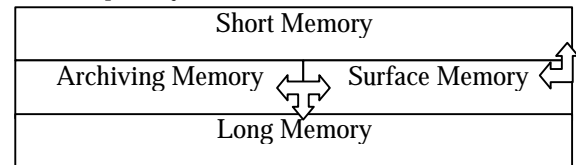

Figure 1 Memory Hierarchy

The inter-relationship between these different levels is complex. These levels can be divided further horizontally or vertically. For example, Surface memory is formed from the active and temporary storage memory of the short memory and a part of the archiving memory, which is shared with the long memory. Archiving memory is the result of continuous review of data in the other levels.

Memory Organization

Our interest here is twofold: the organization of knowledge within concepts and the building of relations, and the forgetting process as a re-organization process. When one perceives some data, one attempts to relate this data to some form of concept. This concept can be a set of objects, a mental concept (e.g. beauty) or one's own conceptual perception of data. This may lead us to believe our memory works as a classifier. Let us take the example of a BMW car. As a classifier our memory will classify BMW as a car but we do not usually use car concept in response to the perception stimuli of BMW. Instead one may say BMW is a car with curvy edges. This links the car to the mathematical shapes concept of type curve. The human conceptualization process is not a straightforward classification. Instead it is a memory organization process of objects classification, generalization and association.

Definition 5 Conceptualization may be defined as a generalization process by associative classification and abstraction.

Definition 5 establishes the relation between conceptualization and classification on one hand and the association between different classes on the other hand. The importance of associations is the fact that one object may be related to more than one concept; and the retrieval of information may depend on the context within which the object appears. The generalization process of classes is based on the abstraction of these classes.

Definition 6 Abstraction is the process of class generalization.

Observation 1 Concept is a set of related abstracts.

Concepts and their associations become a very interesting topic in relation to thinking by building mental images of objects, events and thoughts. This is particularly important for self-reasoning agents [13] to be able mentally to visualize themselves and others within their environment. Without forgetting, however, humans would be hunted down by memories and consumed knowledge. But how the forgetting occurs and why? We are not in the position to answer this question from psychological viewpoint. However our understanding of forgetting here depends on belief revision [14, 15] and on short memory psychological experiments [12]. Two forms of forgetting that interest us are: forgetting by replacement, e.g. forgetting the multiplication tables by replacing them with mathematical rules; and forgetting by elimination. Forgetting by replacement is almost equivalent to conceptualization, while elimination forgetting relates to archiving process.

Conclusion

In this paper a version of memory hierarchy and organization has been presented using some results that are reported in psychology literature. The aim is to develop a memorization process that recognizes perceived objects by anchoring different adjectives as part of conceptualization process. Formal account and implementation of the conceptualization and memorization processes is under construction.

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