AI Magazine Volume 7 Number 1 (1986) (© AAAI)

LETTERS

Editor:

A recent article by Ronald Brachman (Brachman, 1985) points out some philosophical or semantic problems in using the notion of a *prototype,* which is described by using default properties. The problem arises since default properties can be overridden or *cancelled* in representing particular instances, and therefore lack definitional power: *i.e.,* they are not really essential to the concept being represented.

As an example, Brachman presents an elephant joke:

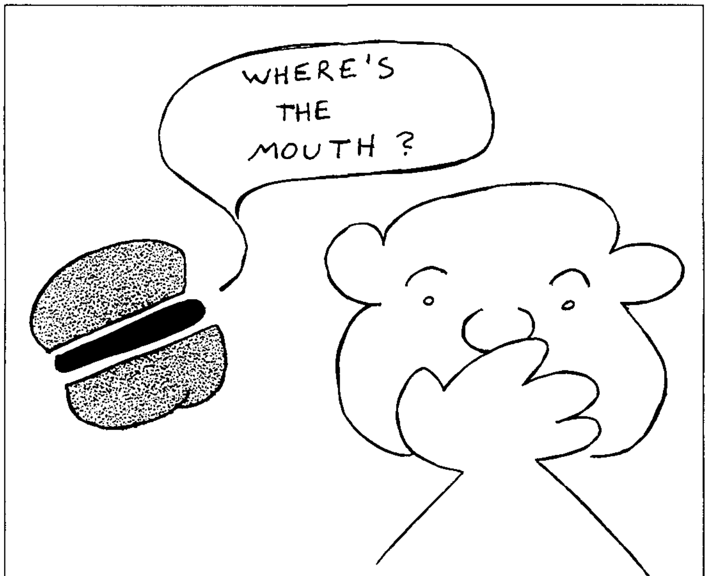
Q: What's big and gray, has a trunk, and lives in the trees?
A: An elephant—I lied about the trees.

Before discussing a solution to this dilemma, consider the following modified version of the elephant joke, perhaps not quite as funny:

Q: What's big and gray, has a trunk, and lives in the trees?
A: An elephant who lives in the trees. PS: I didn't lie about the trees.

To remedy the ailments of default or loosely attached values pointed out by Brachman, particularly in lacking definitional power, I would like to propose a simple alternative to the notion of default values or *loose attachment* or *exceptions.* It is simply the idea that all the properties or values in (slots of) a frame can be considered definitional, or at least not just *defaults,* provided they can be *covered,* obscured, or hidden.

This notion is most clearly illustrated by analogy to visual patterns, which often consist of a background, some object of interest (see figure).



A Common Occlusion.

In fact, such a pattern can itself be considered a frame, where the position of each pixel is a slot, and the shade or color at each pixel is then the attached value. It should then be possible to represent this pattern as I have just described it—*i.e.,* by a frame representing the background, partially obscured or covered by a frame representing the object of interest, partially obscured or covered by some other objects.

The fact that some part of the object of interest is obscured does not mean that it is no longer there, nor that it is not intrinsic to the object's definition.

The purpose for enlisting a *background* frame, for example, including all its parts which are now obscured or not visible, is that it nevertheless provides a simple description of our current observation, and suggests the existence of the parts which are obscured in the current observation.

Before proceeding to define an *occlusion* operator, I'd like to point out that there is generally no probabilistic basis or connection between the value at a particular slot of an object of interest and the value at that slot resulting from some new (occluding) object in the foreground. Consequently, the basis for selecting or *recognizing* the object of interest from an observation cannot be based purely on probabilities, but can be based on the criteria that its selection provides a simpler description or representation of the current observation; *i.e.,* on a *nearest neighbor* or, more generally, on a coding criteria.

In order to define a simple occlusion operator, it is convenient to represent the pattern as an unstructured set.

A pattern is typically represented as an array, such as an array of pixels, or a feature vector. A *higher level* description often attempts to capture the structural aspects of the pattern and specifies the relations between components, as in syntactic pattern recognition schemes. These representations are problematic in representing occlusion: arrays, because of their rectangular regularity, and structured relations, because of their sensitivity to presence of extraneous components or absence of necessary components, and possibly other reasons.

To define an occlusion operator it is convenient to take a step away from structure, and represent the pattern as an unstructured set of pixels (Berman, 1982) where each element or pixel consists of two components; a position component or *slot,* and a value component. In this representation, the pattern corresponds to a concept or frame, and the position of each pixel corresponds to a role (Brachman, 1979) the pixel plays in the pattern (or a *slot* in frame terminology).

Relationships between pixels in a pattern are then implicit and derivable from the *relation* of each pixel to the pattern as a whole (*i.e.,* the position of the pixel). This is a *vivid* (Levesque, 1985) representation consisting of interpixel relationships.

This unstructured set of pixels representation of a pattern is analogous to the popular unstructured set of rules representation of knowledge in that information is maintained in separate and independent modules.

With the pattern represented as an unstructured set, it is possible to form intersections of several patterns in order to extract recurring components, even those consisting of disconnected amorphous regions. (Digression: Try acquiring and representing such recurring components in typical syntactic pattern representations.) It is also possible to unite several such sets in order to form composite descriptions. And here's where the trouble begins.

Suppose one set (a pattern) contains the pixel (t, v) where t is a position (or slot) and v is a value, and the other contains the pixel (t, u), $u \neq v$. If we unite these two sets we obtain the apparent contradiction that both v and u occur at t. The composite set cannot describe any observed pattern, in which only one value can be observed for each position. However, we can define an occlusion operator, denoted by $\vee$, so that for pixel sets A and B

$$\begin{aligned} A \vee B &= A \cup B - \{(t,v) \in A \mid \exists \mu \neq v \ni (t,\mu) \in B\} \\ &= [A - \{(t,v) \in A \mid \exists \mu (t,\mu) \in B\}] \cup B \end{aligned}$$

i.e., A occluded by B consists of all pixels in B, and all pixels in A which are not occluded by (do not have the same position as) pixels in B.

This results in an observable, consistent pixel set, provided A and B were each consistent (in respect to having one value per position).

With the addition of this operator into our description vocabulary, it is possible to describe a pattern (or frame) as a composite of other frames, each retaining the integrity of its definition even though it might not be visible in its entirety.

References

Brachman, R. J. (1985) "I lied about the trees" or, defaults and definition in knowledge representation. *AI Magazine* 6:3.

Brachman, R J (1979) On the epistemological status of semantic networks. In N V Findler (Ed), *Associative networks: Representation and use of knowledge by computers.* New York: Academic Press.

Berman, A. (1982) Set derivatives. *IEEE computer society conference on pattern recognition and image processing (PRIP 82).* Computer Society Press.

Levesque, H. (1985) *Making believers out of computers* Computers and Thought Lecture, IJCAI-9.

A. Berman
Hughes Aircraft Co., RSG
Los Angeles, CA

Editor:

I have not yet finished the winter issue of *AI Magazine,* but respond to an interrupt at page 45 with this offer of assistance.

In the editorial on page 27 you made clear your hesitation about "articles that reviewed or promoted commercial products," and on page 40 began an article that both reviewed and promoted Loops, which presumably is not (yet) a commercial product. The distinction, I suppose, is that those who promote the products of research are rewarded only by promotion and salary increases, while those who promote commercial products are rewarded, on the other hand, by promotions and salary increases.

My own hairs are increasingly valuable to me as the years go by, but if you run out of those to split, let me know.

Robert Rich
1109 Schindler Drive
Silver Spring, Maryland 10903

The intent of Stefik and Bobrow's article was to present a tutorial on object oriented programming. We encouraged the authors to describe and contrast the more popular sytems now in use, which they did. In presenting the basic themes of object-oriented programming, it doesn't make a lot of difference which particular variant is used for illustrative purposes, and it is hardly surprising that authors will concentrate on what they know best.—Ed.

Editor:

The excellent Lenat, Prakash, and Shepherd article on the CYC common sense project was certainly a fascinating one, especially the final example of the sixth assumption. The implication that entering data on "Panthers" will be quite easy after "Lions" had been input was clear enough. However, I did not at first appreciate how the "Guerrillas" entry was going to facilitate much.

Nonetheless, I see now that they are all:

basickindOf:	Dangerous Mammal
eatingHabits:	(Omniverous (prefers meat))
habitat	(Jungles, Mountains, Forests)
movesAroundMainly:	Night
hatetoMeetIn	Dark Alleys

The origin of the word *guerrilla* is immediately from the Spanish *guerra* (war) akin to the Old High German *werra* from whence the English word *war* is also derived. I believe *gorilla* is from the Greek for a mythical tribe of hairy women in Africa.

D. N. Meehan
Champlin Petroleum Company
Houston, Texas 77008

Editor:

It was heartwarming to read about Doug Lenat and associates' CYC project in your winter 1985 issue. CYC seems to be a first step towards a knowledge-based system for all human knowledge. Such a system has been a dream of mine for twenty years. Perhaps the dream is shared by other readers as well.

On the one hand, such an ambitious goal may still seem very distant. For it to be realized, many current trends in computing and communications will have to converge as they continue evolving. Technologies as yet undeveloped may well need to be incorporated. But the pieces of the puzzle do appear to be falling into place.

One of the most critical components to the entire enterprise will not be parallel architectures or optical circuitry or an Integrated Services Digital Network or further astonishing miniaturization or realtime three-dimensional (holo)graphics or any other tangible technology, but will be the wise management of the material in the system.

Whatever label one wishes to give to the human conceptual terrain, some form of semantic network on the scale of an *Encyclopedia Britannica,* taken a few orders of magnitude further in depth, is where we're going. Practical handling of such a mass of information online requires much thought and effort. The CYC team seems to have taken the first step.

That is what is so encouraging. For, on the other hand, CYC's very existence tells me that we have already come a long way since I asked Professor Feigenbaum (as recently as AAAI-83) if he could tell me of anyone working on a knowledge-based system for all human knowledge, and he said "Nobody. That would take fifty years!"

Michael Sussna
34 Willow Road
Beacon, New York 12508

AAAI-86 EXHIBIT PROGRAM

Companies interested in exhibiting at this year's National Conference on Artificial Intelligence can obtain information and an application form from:

Ms. Lorraine Cooper
AAAI
445 Burgess Drive
Menlo Park, CA 94025-3496