

Artificial Intelligence

Unit – V

Chap-XVI

Knowledge Representation

Categories and Objects

- The organization of objects into categories is a vital part of knowledge representation.
- Although interaction with the world takes place at the level of individual objects, *much reasoning takes place at the level of categories.*
- Categories also serve to make predictions about objects once they are classified.
- One infers the presence of certain objects from perceptual input, infers category membership from the perceived properties of the objects, and then uses category information to make predictions about the objects.

Categories and Objects

- There are two choices for representing categories in first-order logic: predicates and objects.
- Categories serve to organize and simplify the knowledge base through inheritance.
- If we say that all instances of the category Food are edible, and if we assert that Fruit is a subclass of Food and Apples is a subclass of Fruit , then we can infer that every apple is edible.
- We say that the individual apples inherit the property of edibility, in this case from their membership in the Food category.

Categories and Objects

- Subclass relations organize categories into a taxonomy, or taxonomic hierarchy.
- Taxonomies have been used explicitly for centuries in technical fields.
- Although subclass and member relations are the most important ones for categories, we also want to be able to state relations between categories that are not subclasses of each other.

Extrinsic & Intrinsic

- What is actually going on is this: some properties are **intrinsic: they belong to the very** substance of the object, rather than to the object as a whole.
- When you cut an instance of *stuff in half*, *the two pieces retain the intrinsic properties—things like density, boiling point, flavor, color, ownership, and so on.*
- On the other hand, their **extrinsic properties—weight, Length, shape, and so on—**are not retained under subdivision. A category of objects that includes in its definition only *intrinsic properties is then a substance, or mass noun; a class that includes any extrinsic properties in its definition is a count noun.*

Mental Events And Mental Objects

- What we need is a model of the mental objects that are in someone's head (or something's
- knowledge base) and of the mental processes that manipulate those mental objects.
- <http://boxesandarrows.com/whats-your-idea-of-a-mental-model/>

Mental Events And Mental Objects

Need to represent *beliefs* in self and other agents, e.g. for controlling reasoning, or for planning actions that involve others

How are beliefs represented?

- ✓ Beliefs are reified as *mental objects*
- ✓ Mental objects are represented as *strings* in a language
- ✓ Inference rules for this language can be defined

Rules for reasoning about logical agents' use their beliefs

$$\forall a, p, q \text{ LogicalAgent}(a) \wedge \text{Believes}(a, p) \wedge \\ \text{Believes}(a, "p \Rightarrow q") \Rightarrow \text{Believes}(a, q)$$

$$\forall a, p \text{ LogicalAgent}(a) \wedge \text{Believes}(a, p) \\ \Rightarrow \text{Believes}(a, "Believes(\text{Name}(a), p)")$$