Wenchy Dutreuil

Writing exercises

Paragraph 1

[Original]

Knowledge representation and reasoning (KRR) is a subfield of artificial intelligence (AI) that is concerned with understanding, designing, and implementing ways of representing information in computers so that agents can use that information to reason and solve problems [3]. KRR is central to the entire field of AI [3]. The agents build primarily around this paradigm are often referred to as knowledge-based agents. The central component of a knowledge-based agent is its knowledge base, or KB [1]. A knowledge base is a set of sentences; each sentence is expressed in a knowledge representation language and represents some assertion about the world [1]. Deriving information that is implied by the information that is already present is a form of reasoning [3]. Decision procedures constitute another component of reasoning [9]. A challenge to work in KRR is its complexity; a “minimal” common-sense system must “know” something about cause-and-effect, time, purpose, locality, process, and types of knowledge. It also needs ways to acquire, represent, and use such knowledge [7].

[Revised]

Knowledge representation and reasoning (KRR) is a subfield of artificial intelligence (AI) that is concerned with ways of representing information in computers so that that agents can use that information to reason and solve problems [3]. The agents built primarily around this paradigm are often referred to as knowledge-based agents. The central component of a knowledge-based agent is its knowledge base, or KB [1]. A knowledge base is a set of sentences; each sentence is expressed in a knowledge representation language and represents some assertion about the world [1]. Deriving information that is implied by the information that is already present is a form of reasoning [3]. Decision procedures constitute another component of reasoning [9]. A challenge to work in KRR is its complexity; a “minimal” common-sense system must “know” something about cause-and-effect, time, purpose, locality, process, and types of knowledge. It also needs ways to acquire, represent, and use such knowledge [7].

Paragraph 2

One of the more common methods of knowledge representation is logic. Logic was the dominant paradigm in AI before the 1990s, but it had some drawbacks due to it being deterministic and rule based [4]. Despite these drawbacks it is very expressive and compact [4]. There are several different types of logics, such as: propositional, first-order, second-order, modal, fuzzy etc. [5]. The goals of logical languages are to represent and reason about knowledge in the real world [4], there is a direct relation between the goals of KRR and logical languages.

In propositional logic there are propositional symbols and logical connectives (not, and, or, implication, bidirectional implication) that are used to build up every logical formula [4]. A logical formula compactly represents a set of models where that formula is true [4]; for example, if we have propositional symbols P and Q, then P V Q represents all the worlds where P is true, or Q is true. In the logical paradigm, each sentence in a KB can be thought of as a logical formula that describes a set of models. For logical inferencing using propositional logic our agent can use either modus ponens or resolution [6]. Modus Ponens is sound and complete for propositional logic with horn clause, and resolution is complete for propositional logic in general.

Unfortunately, propositional logic is limited in its expressiveness; as a result, first-order logic adds variables, functions, and quantification. First-order logic has two types of quantifiers, universal and existential. The universal quantifier argue that every member of a group meets a condition, and the existential quantifier argues at least one member of a group meets a condition. If we also impose the restriction that there is a one-to-one mapping from object to constant symbol in first-order logic, then the consequence is this idea of propositionalization, where first-order logic is just syntactic sugar for propositional logic, and as a result we can use any inference algorithm for propositional logic on first-order logic [6].

Paragraph 3

[Original]

(Coclusion paragraph, didn’t exist before)

[Revised]

Despite the apparent separateness of the two discussed forms of KRR, logic and frames, they are not mutually exclusive. It is often the case that frame systems have their semantics defined as an extension to first-order logic. In addition, restricted and ad hoc forms of logical reasoning can be employed to derive new information. This coalescing of ideas helps to improve both systems.