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Refereed Article

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Object-Oriented First-Order Logic

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Abstract: *This paper describes a novel logic that extends First-Order Logic (FOL) to create counterparts of the Object-Oriented paradigm. We call it Object-Oriented First-Order Logic (OOFOL). FOL provides richness of representation, but is unwieldy in modeling large, complex tasks. On the other hand, the Object-Oriented paradigm has been successful at treating large, complex tasks in both software and knowledge engineering.*

In OOFOL, objects are theories that are connected via interface vocabularies to other objects, classes are used to provide a reusable logical template, and inheritance is used to adapt classes to specialized tasks. We show that such a logic can be given simple semantics using FOL. A variant of the logic that allows links between the objects to be unidirectional is also examined. This variant is called Directed Object-Oriented First-Order Logic (Directed OOFOL). We show that such a system can be given semantics using Circumscription.

Our new tools facilitate the object-oriented design of theories. We demonstrate this through a few applications taken from model-based reasoning, theories of action and cognitive robotics. These examples also demonstrate the use of the object-oriented methodology and tools for the construction of first-order theories. We conclude with proposed inference algorithms for these logics.

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