Abstract Logic via the Unification of Abductive and Inductive Inferences

Vishal Lall
Emory University
vlall@emory.edu

Abstract:
Modern AI systems are equipped with rapid deductive capabilities using high-level statistical modeling and probability networks. However, the limits of AI progression lie in their insufficient inductive ability to achieve human-like expression and intelligence. Contextual abstraction is the ability for an agent to objectify what logician Gottlieb Frege would refer to as an *abstract object*, a non-mental, non-sensible entity in their environment defined by empirical relationships. Abstract logic occurs when a system uses these entities to carry out logical inferences to ascertain causal determinants. Our problem is AI systems are constructed of hierarchical systems, thus the line between abstraction and categorization must remain separate for successful inference. By unifying two casual inferences, both induction and abduction, and using abstract objects as variables, a system will be able to sufficiently query not only categorical events, but understand the nature of contextual abstraction in human expression. The result will be machines with effective hypotheses formulations on abstract concepts, in effect, performing scientific and philosophical inferences from purely logical operations.

Introduction:

The problem of abstraction is that an entity cannot be fully defined and exists rather as a relationship that allows for interpretation outside of the context of static definitions of our physical world. As experience increases, these relationships change, as does the meaning of the abstract object. The ambiguity of an abstract object causes difficulties in the understanding of their composition. Often discussed in analytical philosophical, ambiguity gives rise to the conceptual understandings and misunderstandings that exist in individual interpretation of abstract objects. Our goal here is not to justify these subjective systems, but rather give a method by which we come to understand the abstractions around us, and how this process makes discourse inherently difficult. The second purpose is to apply this abstraction in structured logical language, allowing the process to be recreated by algorithmic design. A given systems experience will be entirely different from our own, and therefore, machine learning techniques will help promote abstraction using induction.

Relationships of objects are further complicated when they are defined by abstractions themselves. This is almost a recursive idea being embedded into a system to further the degree of ambiguity. A common way of understanding the lines drawn for the extent of this is by considering our definition of what constitutes the abstraction and what does not constitute the abstraction. Understanding a function that is capable of ascertaining truth simultaneously requires it to judge the falsehood of the nature of the system it exists within. Russell's logical idea that C(x) means `It is f false that ``C(x) is false'' is always true.' (On Denoting) draws forward that it the truth-value of a given proposition is a delimiter on a set's given possible propositions. The further this delimiter is capable of minimizing a set's possible elements, the more accurate an agents inference proposals function. A systems inferences certainty on certain inferences is therefore important because the higher our certainty, the further capabilities we have in narrowing a set's possible elements. If, however, we accept an uncertain inferential premise, we may unknowingly eliminate an element from the set that could prove useful for other inferences.

Variables in a given set are capable of being unified through both inductive and abductive processes. Unifying patterns amongst variables can be interpreted on a number of levels. The process for such inference must first start with a search for the rule (induction) an examination of the domain problem (abduction), and finally an outlining of the steps that should be taken given the information (deduction).

Since our definition of abstract objects is dependent on the relationship between our experiences, it is defined by a highly subjective method of inference. Charles Sanders Pierce introduced the following definition of abduction:

$$T \cup H \models O$$

The difficulties of abstraction and categorization are most relevant in the following proof:

B is a subset of A
B exists iff A exists
B exists
$\therefore$ A exists

The fallacy committed here is that the following

proof defines abstraction as categorization:

$$B \vee C \vee D \supset A$$

The following is a more accurate definition of an abstract object:

$$B \cup C \cup D \vDash A$$

In this equation, the union between related variables composes the abstract object, just as Frege suggests. We can look at this unification of abstraction in terms of our equation for induction. Abduction is an impossible process without first understanding the rule required to unify the problem domain.