Current Interactions between Category Theory and Conceptual Spaces
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Introduction

There are not many literature sources on the interaction between Category Theory and Conceptual Spaces. One of the reasons might be due to skepticism about very existence of any interactions between these fields. Having said that, there is a growing interest in Applied Category Theory and ways of applying ideas from Category Theory to machine learning, human cognition and natural language processing (NLP). In this note we tried to outline some of the works connecting Category Theory and Conceptual Spaces. In doing so, we can learn about a set of ideas involved in making the connection between the given seemingly unrelated fields.

Ideas and Results

Category Theory and Higher Dimensional Algebra: potential descriptive tools in neuroscience

In the mentioned paper Ronald Brown and Timothy Porter try to apply the idea of colimit in the context of neuroscience. It is known that an idea of colimit of a diagram has a capacity to codify some information about the given diagram in some category. By considering categories related to neuroscience and cognition, it is possible to encode relationship between many objects into a single object. It might prove to be useful in representing quite complex concepts and ideas.

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In the mentioned paper Joe Bolt, Bob Coecke, Fabrizio Genovese, Martha Lewis, Dan Marsden and Robin Piedeleu formalize the notion of convex conceptual spaces using complex algebras. Then they use category theory to represent nouns, nouns with adjectives and other types of parts of speech.

Using Conceptual Spaces to Model Domain Knowledge in Data-to-Text Systems

In this paper Hadi Banaee and Amy Loutfi propose to use a conceptual space to represent various textual observations and patterns. Then points in the conceptual spaces help to generate the text for given observations and patterns.

Discussion

We have mentioned three works which combine category theoretic notions with conceptual spaces. One could wonder if category theory might have even more applications in conceptual spaces and in the larger context of knowledge representation. This is the aim of this project series.

Further Reading

- Category Theory and Higher Dimensional Algebra: potential descriptive tools in neuroscience
- Joe Bolt, Bob Coecke, Fabrizio Genovese, Martha Lewis, Dan Marsden, and Robin Piedeleu, Interacting Conceptual Spaces I

- Hadi Banaee and Amy Loutfi, Using Conceptual Spaces to Model Domain Knowledge in Data-to-Text Systems