The ZX-calculus comprises a set of rewrite rules for manipulation of ZX-diagrams, a diagrammatic representation of quantum operations. The ZX-calculus is an example of a symmetric monoidal category. ZX-diagrams are graphs that consist of red and green nodes, called Z and X spiders respectively. Each spider has a number of inputs and outputs (dimensions), as well as a rotational angle. Spiders can be connected via edges.

The ZX-calculus has two important rules: only connectivity matters. Wires can be arbitrarily deformed as long as the input and output order to the overall diagram is maintained. Swapping red and green everywhere preserves the truth of a rule.

The canonical representation of the ZX-calculus is primarily graphical. Thus, it seems natural that a visualization would make terms clearer. However, the inductive structure representing string diagrams & structural information over connectivity information. In this case, we are left with a slightly more complex visualization of the term, carrying more syntactic information.

What's the problem?

Because the inductive representation carries a lot of structural information, textual representations of diagrams can be deeply nested, and hard to parse. This makes it difficult to identify sub-structures that can potentially be rewritten.

What's the solution?

The canonical representation of the ZX-calculus is primarily graphical. Though our inductive structure conveys the same semantics as the graphical structure, we want to focus on the diagram’s structure rather than its connectivity information. Using the canonical visual syntax thus would not be helpful; we must design a visualization that emphasizes structural information over connectivity information.

VISUALIZING GRAPHICAL PROOFS IN COQ


VyZX: Verification of the ZX-calculus

VyZX: A Visualization for verifying the ZX-calculus

REFERENCES