DisCoPy for the quantum computer scientist

(as pdf here)

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Summary

The researchers bring us a review of the recent developments of the DisCoPy library. DisCoPy (Distributional Compositional Python) is an open-source toolbox for computing with string diagrams and functors. Writers mention some data structures and functions useful for quantum circuits and ZX-calculus. We learned that DisCoPy is compatible with PyZX and thus has methods that allow automated rewriting and translating back and forth between DicCoPy circuits and ZX diagrams. Writers also presented an example of a post-selected quantum teleportation protocol.

Objective

The researchers aimed to design an instrument combining the best properties from PyZX and homotopy.io. That means they aspired to develop a high-performance computing tool that would be able to represent arbitrary n-dimensional diagrams.

Research done

The writers prepared a summary of the most important classes and methods in DisCoPy. They examined the class `Diagram` and its subclass `Circuit` together with their functions. We learned that DisCoPy offers classes like `Gate`, `Bra` or `Ket` used for encoding unitary quantum gates. The scientists pointed out some types such as `Measure` and `Encode` that allow going from `qubit` to `bit` and vice versa or class `Discard`, which lets us trace out a `qubit`. Lastly, they mentioned the `photonics` module, which is still under development but has a high potential for future research.

New contributions

The DisCoPy (Distributional Compositional Python) is an open-source toolbox for computing with string diagrams and functors. DisCoPy comes with comprehensive documentation and many interactive samples, which we can access on the discopy website, pdf documentation.

Future Directions

Recent theoretical progress on a graphical calculus for linear optics opens the door to new opportunities. Its implementation will result in the possibility that DisCoPy functors will enable compiling qubit circuits and ZX diagrams into linear optical circuits. It is just a one-step on the photonic roadmap toward fault-tolerant quantum computing.