

Modeling Complex Systems with Category Theory

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Objective and Scope of the Project

Scope of the Project

My objective for this project was to learn about the brand new field of categorical systems theory , which applies the pure math field of category theory to the study of arbitrary systems , and then use the tools that I learned to model a complex real-world system.

But I didn't know category theory or any complex systems...

The Actual Scope of the Project

1. Learn Category Theory
2. Learn Categorical Systems Theory
3. Write a software package for it in Python
4. Learn about a real world system (Transcription Networks)
5. Model it and simulate the results
6. Live to tell you all about it

Scope of this Presentation

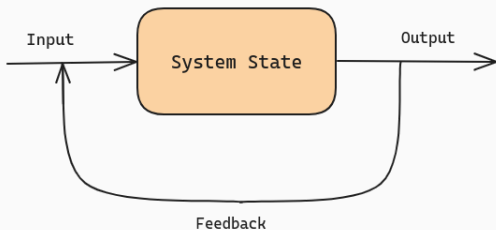
Keep things high-level and descriptive and move fast.

1. Tell you what a system is.
2. Tell you what a category is.
3. Tell you how they can work together.
4. Show you a complex system and how I modeled it.
5. Talk about the simulation results.

Systems

What is a System?

Probably the simplest way to think of a system is as a box with information coming in and information coming out, and with these two information streams being connected by feedback.



What is a System?

Let's make this more precise.

Definition (System)

A system is a collection of states and a pair of functions on those states that (1) expose some of the internal state to the outside world and (2) update the system's state based on the system's current state and current inputs.

Example of a System

Categories

Composing Systems

Case Study

Results

Conclusion
