

SSIE 583 Project: Generating Look-up tables from Partial Input Data in CANA

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Abstract

Introduction

CANA: A Python Package for Quantifying Control and Canalization in Boolean Networks (Correia et al., 2018) is a powerful tool designed to extract, measure, and visualize canalizing redundancy and effective pathways in controlling dynamics present in Boolean network models. It does so with tools such as the 'effective graph' and 'dynamics canalizing map' as well as others to 'uncover minimum sets of control variables', which are important for controlling and manipulating biological systems. This makes CANA a valuable tool for studying and analyzing complex systems in the field of computational biology and systems biology.

While effective graphs and two-symbol schemata allow us to boil down the output rules to its bare essentials and capture relationships hidden in redundancies, this paper will focus on an addition made to the toolkit of CANA- the ability to generate look-up tables from partially described boolean networks. This feature allows users to efficiently interpolate and extrapolate data points, identifying gaps in input data, and potential contradictions in the lookup table.

Background

Currently, CANA has two types of inputs that instantiate a Boolean Node in a Boolean Network.

The **lookup table input**- a list of 2-tuples, where the first element is a binary string of length k and the second element is a binary string of length 1. For example, the lookup table input for a node with $k = 2$ would look like this:

The CANA package also accepts a

Acknowledgements

References

Correia, R. B., Gates, A. J., Wang, X., and Rocha, L. M. (2018). Cana: A python package for quantifying control and canalization in boolean networks. *Frontiers in Physiology*, 9:1046.

Input	Output
00	0
01	1
10	0
11	1

Table 1: Boolean Input for Three Inputs

Input	Output	Input	Output
01	1	01	1
11	1	11	1

Table 2: Boolean table for Three inputs only specifying a '1' output