Title: Vaccinating a Population is a Programming Problem

Abstract:

It is important to understand how best to apply a limited number of vaccines to a population such that the spread of a disease, like SARS-CoV-2, is minimized. Although intuition provides a number of mitigation strategies that may be effective, they remain largely untested.

A system was developed to test a given disease mitigation strategy. It is designed to work with a graph representing real social networks. A powerful form of artificial intelligence called *Genetic Programming* was used to discover novel mitigation strategies that are easily interpretable, an important requirement for a public health decision makers and stakeholders.

Effective strategies were developed by the GP system. The strategies are easily explainable and intuitive. Novel mitigation strategies were compared to simple baseline strategies with varying success using a number of different metrics. Many of these strategies proved effective in general; however, the topology of the graph influences the effectiveness of a strategy.

The system is in the early stages of development and is consistently being improved. It has also been made publicly available and the authors call on the research community to contribute their own mitigation strategies and ideas to the system.

Bio:

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James Hughes completed his BSc honours at Brock University studying Computer Science and Physics in December 2012. He defended his MSc degree in Computer Science focusing on Bioinformatics at Brock under the supervision of Dr. Sheridan Houghten in August 2014. James moved to London Ontario to pursue his PhD at the University of Western Ontario where he studied Computer Science, Artificial Intelligence, and Neuroinformatics under the supervision of Dr. Mark Daley – the current Vice-President Research at the Canadian Institute for Advanced Research. James defended his thesis in July 2018 and began his appointment at St. Francis Xavier University in August 2018. He is currently an Assistant Professor of Computer Science, designated the Alley Heaps Associate Chair, and the Dr. WF James Chair (scholar) in Pure and Applied Sciences.

James' interests include the development of machine learning algorithms for real world applications. Although he is interested in many algorithms, particular strategies of interest are Evolutionary Computation and Artificial Neural Networks. Application areas include neuroinformatics, bioinformatics, kinematics, geology, art, finance, and clinical applications.