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Enhancing Epidemiological Models with Parameter Estimation and Symbolic Regression: A Case Study on COVID-19

Shila Rezvani* Mostafa Abbaszadeh† Mehdi Dehghan‡

Abstract

This study explores three significant topics in contemporary research: parameter estimation, Symbolic Regression and the COVID-19 pandemic. Parameter estimation is a fundamental aspect of statistical analysis, focusing on deriving unknown parameter values from empirical data. This study employs methodologies such as Maximum Likelihood Estimation (MLE) and advanced modeling techniques to refine the system of equations for a better fit to observed data. In the context of the COVID-19 pandemic, parameter estimation plays a pivotal role in developing epidemiological models that inform public health strategies. The SIDARTHE model, for instance, offers an innovative approach by categorizing individuals based on their infection status and Severity of symptoms, providing crucial insights into the virus's transmission dynamics. In addition to traditional parameter estimation, this work leverages Symbolic Regression (SR) to update and refine the right-hand side of the system of equations based on the data. SR, a machine learning-based regression technique rooted in genetic programming, uncovers new equations. By integrating statistical methods, SR and epidemic modeling, this study highlights the importance of simultaneously updating coefficients and discovering new governing equations to enhance our understanding of disease spread and guide effective intervention measures.

Keywords: Parameter estimation, Covid-19, Symbolic Regression

*Department of Computer Science, Amirkabir University of Technology, rezvani8080shila@gmail.com
†Department of Computer Science, Amirkabir University of Technology, m.abbaszadeh@aut.ac.ir
‡Department of Computer Science, Amirkabir University of Technology, mdehghan@aut.ac.ir