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Parameter Estimation for COVID-19 SVIRD Model Using Predictor-Corrector Algorithm

Alejandra D. Herrera Reyes
The University of Nottingham, alejandra.d.herrera.r@gmail.com

Susan Rogowski
Florida State University

Diana White
Clarkson University

See next page for additional authors

Presenter Information

Alejandra D. Herrera Reyes, Susan Rogowski, Diana White, Alexandra B. Smirnova, Ruiyan Luo, and Yena Kim

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Ruiyan Luo, Alejandra D. Herrera-Reyes, Yena Kim, Susan Rogowski, Diana White and Alexandra Smirnova

Abstract Stable parameter estimation is an ongoing challenge within biomathematics, especially in epidemiology. Oftentimes epidemiological models are composed of large numbers of equations and parameters. High dimensionality makes classic parameter estimation approaches, such as least square fitting, computationally expensive, and the presence of observational noise and reporting errors that accompany real-time data can make these parameter estimation problems ill-posed and unstable. The recent COVID-19 pandemic highlighted the need for efficient parameter estimation tools. In this paper, we develop a modified version of a regularized predictor-corrector algorithm aimed at stable low-cost reconstruction of infectious disease parameters. This method is applied to a new compartmental model describing COVID-19 dynamics, which accounts for vaccination and immunity loss (from vaccinated and recovered populations). Numerical simulations are carried out with synthetic and real data for COVID-19 pandemic. Based on the reconstructed disease transmission rates (and known mitigation measures), observations on historical trends of COVID-19 in the states of Georgia and California are presented. Such observations can be used to provide insights into future COVID policies.

Key Words Epidemiology, alternating minimization, compartmental model, regularization.

Ruiyan Luo
Department of Population Health Sciences, School of Public Health, Georgia State University, Atlanta, USA, e-mail: rluo@gsu.edu

Alejandra D. Herrera-Reyes
School of Mathematical Sciences, University of Nottingham, Nottingham, UK, e-mail: alejandra.herrera@nottingham.ac.uk

Yena Kim
Hawaii Pacific University, Honolulu, USA, e-mail: yekim@hpu.edu

Susan Rogowski
Department of Mathematics, Florida State University, Tallahassee, USA, e-mail: srogowski@fsu.edu

Diana White
Department of Mathematics & Statistics, Clarkson University, Potsdam, NY, USA, e-mail: dtwhite@clarkson.edu

Alexandra Smirnova
Department of Mathematics & Statistics, Georgia State University, Atlanta, USA. Supported by NSF award 2011622 (DMS Computational Mathematics) e-mail: asmirnova@gsu.edu