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Feasible Modelling and Prediction of COVID-19 Outbreaks

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ABSTRACT

We formulate the ill-posedness of inverse problems of estimation and prediction for COVID-19 outbreaks from the statistical and mathematical perspectives. These leave us with a plenty of possible statistical regularizations, thus generating plethora of sub-problems. We can mention the as examples stability and sensitivity of peak estimation, starting point of exponential growth curve, or estimation of parameters of SIR model. We also illustrate that several country-specific covariates, e.g. social structure, or air pollutions, etc. can play a crucial way in regularization of the estimators. We will illustrate this on example of Chile, where start of exponential growth, grounded on microbiological- epidemiological model was severely underestimated. Moreover, in a specific country, one can define several social groups which can contribute in a heterogeneous way to whole country epidemiological curves. For parametric models of epidemic curves, each parameter has its own specific sensitivity, and naturally, the more sensitive parameter deserves a special attention. E.g. in SIR (Susceptible- Infected-Removed) model, parameter β is more sensitive than parameter γ. In simple exponential epidemic growth model, b parameter is more sensitive than a parameter. We provide sensitivity and illustrate it on the country specific data. We also discuss on statistical quality of COVID-19 incidence prediction, where we justify an exponential curve considering the microbial growth in ideal conditions for epidemic. We model number of infected in Iowa State, USA, Hubei Province in China, New York State, USA. All empirical data justifies an exponential growth curve for initial prediction during epidemics. We also discuss on several peculiarities of COVID-19 prediction in Chile and Slovak Republic. Author acknowledges support of WTZ Project BG 09/2017 (Austria-Bulgaria).

Keywords: SARS-CoV, COVID-19, Modelling, Parametric models, COVID-19 prediction, Chile

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