Abstract

We propose a generalized non-linear state-space model for count-valued time series of COVID- 19 fatalities. To capture the dynamic changes in daily COVID-19 death counts, we specify a latent state process that involves second order differencing and an AR(1)-ARCH(1) model. These model- ing choices are motivated by the application and validated by model assessment. We consider and fit a progression of Bayesian hierarchical models under this general framework. Using COVID-19 daily death counts from New York City's five boroughs, we evaluate and compare the considered models through predictive model assessment. Our findings justify the elements included in the proposed model. The proposed model is further applied to time series of COVID-19 deaths from the four most populous counties in Texas. These model fits illuminate dynamics associated with multiple dynamic phases and show the applicability of the framework to localities beyond New York City.

KEYWORDS:

Count valued time series, State-space models, Bayesian estimation, COVID-19 modeling