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Forecasting epidemic trajectories using simple dynamic models

Mathematical models provide a quantitative framework with which scientists can assess hypotheses on the potential underlying mechanisms that explain patterns in observed data at different spatial and temporal scales, generate estimates of key kinetic parameters, assess the impact of interventions, optimize the impact of control strategies, and generate forecasts. We review and illustrate a simple data assimilation framework for calibrating mathematical models based on ordinary differential equation models using time series data describing the temporal progression of case counts relating, for instance, to population growth or infectious disease transmission dynamics. We will present results from recent forecasting efforts in the context of emerging infectious diseases using phenomenological and mechanistic models. In the process, we also discuss issues related to parameter identifiability, uncertainty quantification and propagation.