

Bayesian framework for forecasting an ongoing epidemic: using several models simultaneously.

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Abstract

The COVID-19 pandemic took decision makers by surprise. In lack of sufficient empirical evidence, important decisions were often based on modelling instead. However, choosing an appropriate epidemiological model is complicated by the vast diversity of available platforms (SIR-type models, Agent-based models, Regressions). Sometimes, even small changes in model formulation may affect the forecasts.

There are two standard ways for handling uncertainty in models: model selection (picking the best model according to some criteria, e.g. how well it can describe the already observed data) and model averaging (i.e. building a meta-model incorporating different models).

In this presentation, I will argue for a third approach, sometimes referred as the Bayesian framework: using several models simultaneously. One can build several models and calibrate them to the same data. Instead of averaging the forecasts, however, one compares them and looks for discrepancies between the model outputs. This makes it possible to evaluate the forecasts' robustness to model choice, and helps identifying important model features. As the empirical evidence accumulates, the set of models to be compared can be updated.

The approach is illustrated by the attempt to forecast the COVID-19 epidemic in 2020 by Finnish Institute for Health and Welfare (THL). The drawbacks of this approach include the higher computational cost and difficulties in communicating the results.