Identifiability and observability for a class of epidemiological models

Authors:

- Benjamin Ivorra, Universidad Complutense de Madrid & Instituto de Matemática Interdisciplinar (ivorra@ucm.es)
- Alicja B. Kubik, Universidad Complutense de Madrid & Instituto de Matemática Interdisciplinar (akubik@ucm.es)
- Ángel M. Ramos, Universidad Complutense de Madrid & Instituto de Matemática Interdisciplinar (angel@mat.ucm.es)
- Alain Rapaport, Université de Montpellier, INRAE & Institut Agro (alain.rapaport@inrae.fr)

Abstract: Mathematical modelling is widely used for the study of epidemics. Some of the most famous models are the so-called compartmental models, which separate the population in different disjoint groups attending to their health state: for example, the broadly known Susceptible, Infectious and Recovered compartments. These models are usually systems of ODEs, which are the ones we are going to address.

A typical methodology to apply these models to a real epidemic is the following: setting a model considering the main known features of the disease, looking for the parameters that are available in the literature, and recollecting real data series to calibrate the remaining parameters and (if necessary) initial conditions. However, before doing such a calibration, one can wonder the following: given the known data, can we recover the unknowns univocally? This question is addressed by the theories of *identifiability* and *observability*.

Both identifiability and observability theories have been widely used in different fields, such as bioreactors, navigation, or electronics. However, it is not that common in epidemics (see [**?**] and the references therein). In [**?**], we present a class of systems such that, under some hypotheses, we can identify and observe them. Moreover, we provide a constructive way to recover both the initial conditions and the parameters. Many epidemiological models are included in this class of systems; in particular, we will illustrate this theory through some basic examples.

References:

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