Eighth Workshop Dynamical Systems Applied
to Biology and Natural Sciences DSABNS 2017
Évora, Portugal, January 31st - February 3rd, 2017

EPIDEMICS MODELING USING STOCHASTIC TIME-VARYING PARAMETERS AND BAYESIAN FRAMEWORK

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Epidemics are complex phenomena often modeled using non-linear dynamical systems. Moreover, several factors such as behavioral changes, environmental modification and public interventions can modify the course of the different epidemics. To capture these modifications, in the absence of appropriate external data sources, changes in the key parameters over time have been described by using diffusion processes. Coupled with a Bayesian framework, this approach allows us to obtain quantitative information on the time-evolution of some parameters of major epidemiological significance (average transmission rate for instance). Twenty years ago we showed the value of this approach using the extended Kalman filter to explain the HIV propagation [1, 2]. Now with new Bayesian approaches such as Particles MCMC and using data both from toy models and long datasets from flu and dengue epidemics, we show that time-varying parameters can improve the accuracy of model predictions. Hence a better representation of uncertainty is given in the absence of complete observation of the epidemics.

References

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 ISBN: 978-989-98750-3-6