Modeling Spatial Temporal Epidemics using STBL Model

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Abstract

Time series models have been frequently applied to disease incidence counts as part of this monitoring progress. Unfortunately, standard linear models are generally unable to identify short term changes such as would occur in a disease outbreak. Rather, bilinear models are demonstrably better suited to modeling time series data which feature shocks to the process as would occur in an outbreak of new cases. Additionally, many disease occur in locations that are part of a broader region, rather than occurring in isolation at any particular site. This realization led to the development of the space time bilinear time series(STBL) model by Dai and Billard(1998). We apply the STBL model to a set of U.S. mumps data over a 12 state region, and in a comparative analysis we show how the STBL model gives a better fit overall than do fits of the standard linear time series models that have traditionally been used. In particular, it is observed that the outbreak of 1990-2000 is identified well by the STBL model, and that this model outperforms that other models when performance is based on the usual criteria.

Keywords: Space time bilinear model; Maximum likelihood estimation; Kalman filter; Mumps data; Predictions.

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