Fitting complex difference system models to longitudinal asymmetric proximity matrices

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Abstract
Possible complex difference system models and their algorithms will be discussed for the analysis of longitudinal asymmetric proximity matrices, whose elements may be intensities of proximity among members of either small formal, or informal groups. Members are naturally assumed to be embedded in a finite-dimensional complex Hilbert space or an indefinite metric space according to the Chino-Shiraiwa theorem (Chino & Shiraiwa, 1993). Although Chino has proposed several such system models (Chino, 2000, 2003), he has shown no algorithms for estimating their unknown parameters yet. Here, we discuss two types of models which will enable us to estimate unknown parameters of Chino's primitive models. One of them assumes 1) the existence of measurement errors to observed proximities, s_{jkt}, where t denotes time t, and 2) the latent nonlinear deterministic dynamic system model to the real part as well as the imaginary part of the complex coordinate of each member of a group. A simple LS method might provide the first approximations to the estimates of the unknown parameters of a simple linear model (but the model itself is nonlinear with respect to those coordinates). Since the latent process is assumed to be deterministic, and since the process is complex, we will have to examine whether the system exhibits chaotic behavior in the case of a general model. The other assumes a *nonlinear state space model* (for example, Durbin & Koopman, 2001). The major purpose of this model is to forecast the means and variances of coordinates of members at time t based on the observations $s_{jk,1}, s_{jk,2}, \cdots, s_{jk,t-1}$.

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